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# Miracle Men of the Telephone

By F. Barrows Colton

In observance of the centennial of the birth of Alexander Graham Bell, inventor of the telephone, on March 3, 1947, the National Geographic Magazine presents this story of the Bell Telephone Laboratories, which carry on the work that Dr. Bell began. Dr. Bell was one of the original members of the National Geographic Society when it was founded in 1888. While President of The Society, 1898 to 1903, he initiated the extension of its membership and the popularization of its Magazine. He contributed to the National Geographic Magazine and served as a trustee of The Society until his death in 1922. Mrs. Bell and her family gave The Society its first building, Hubbard Memorial Hall, in memory of Gardiner Greene Hubbard, first President of the Bell Telephone Company and first President of the National Geographic Society.

IN A quiet room in downtown New York I sat one day with a scientist and a man who had been totally deaf from birth. He never had heard a human voice.

Before us were a small luminescent screen, a microphone, and some complicated electrical apparatus. Turning so that the deaf man could not read his lips, the scientist spoke into the microphone. As he talked, a series of patterns of dull greenish-yellow lines and shadows moved slowly across the screen, rising and falling, now blurred, now sharp.

Watching the screen, the deaf man smiled and repeated aloud the words the scientist had spoken—words he could not hear. "All of it was perfectly clear," he said. "I can read those patterns now about as easily as print."

What he was reading was "visible speech," a by-product of the never-ending study of transmission of the human voice carried on at Bell Telephone Laboratories. With it, spoken words are turned into visible patterns on a screen that it is possible to learn to read. Like shorthand, they are patterns not of words but of sounds. They provide a new way of studying speech and, better still, a new way for the deaf to "hear by seeing" (pages 300, 301).

"Visible speech" is only one of the countless achievements of the more than 2,000 scientists and engineers of the Bell Telephone Laboratories. They, with as many more associates, carry on today in this great research institution the work begun more than 70 years ago in a Boston attic by Alexander Graham Bell, inventor of the telephone (page 281).* These men today are "inventing" the telephone of tomorrow.

Amazing things they do make them seem indeed like "miracle men." Yet, like all scientists, they actually get results only by long, hard work, over months and years.

"Our job, essentially, is to devise and develop facilities which will enable two human beings anywhere in the world to talk to each other as clearly as if they were face to face and to do this economically as well as efficiently," Dr. O. E. Buckley, President of Bell Laboratories, told me.

"To this end we study everything from the most fundamental matters, such as the mechanism of speech and hearing and the molecular structure of copper wire and rubber insulation, to the detailed design of equipment. We're equally interested in an operator's enunciation and in building her switchboard for long life."

Everything that happens to human speech between the brain of a speaker in Los Angeles and the brain of the man he is calling, either

* See, in the National Geographic Magazine, "Miracle of Talking by Telephone," by F. Barrows Colton, October, 1937, and "Prehistoric Telephone Days," by Alexander Graham Bell, March, 1922.



**Alexander Graham Bell and Mrs. Bell in Their Garden at Baddeck, Nova Scotia**

The inventor of the telephone was born at Edinburgh and became a citizen of the United States and resident of Washington, D. C., in 1882. Until the day of his death, August 2, 1922, his active mind delved into an amazing variety of subjects, including aviation, sheep breeding, distilling fresh water from salt, high-speed motorboats, and many others. Mrs. Bell (Mabel Hubbard) became totally deaf at age four from scarlet fever. She and Jennie Lippitt were the first children in America to learn to read the lips and converse like hearing people.

in the next block or in far-away Portland, Maine—or even Paris or Shanghai—is the concern of Bell Laboratories people.

That includes such diverse things as taking movies of human vocal cords in action; choking off mischievous round-the-world radio echoes that occasionally distort transoceanic telephone talk; and harnessing the energies of countless electrons which are so small that no one ever has seen one and which, in fact, may not have any definite form at all!

Out of all their work has come not only the world's finest telephone system but many other useful things not connected directly with the telephone. Among them are many phases of radio broadcasting, talking movies, and public-address systems.

Out of telephone research, too, came the electrical gun director, which gave Allied anti-aircraft batteries in World War II almost miraculous accuracy; the mirrophone, which shows you how your own voice sounds, so that you can improve your speaking or singing; and of course "visible speech."

How Alexander Graham Bell, born in Scotland 100 years ago, March 3, 1847, would have rejoiced at "visible speech"! He was originally a teacher of the deaf, and it was his quest for better means of teaching them to speak that led him to invention of the telephone (page 282). Bell himself once tried with only modest success to work out a similar idea as an aid in teaching his deaf pupils to utter sounds properly.

Though not yet ready for general use, modern "visible speech" has great possibilities. Deaf people can and have learned to read it, and thus use it to "see" what others are saying. Hooked on to a telephone or radio, it would serve the same purpose, though that is still in the future.

### Teaching the Deaf to Speak

Better still, deaf people can use it to improve their speech, a difficult task normally for those who are deaf from birth or early childhood, for they are unable to hear the proper pronunciation of words and their speech is likely to be harsh and unnatural.

With "visible speech" they can practice by watching the patterns of their voices on the screen and comparing them with patterns of normal speech, until they learn to speak correctly. Its use in teaching deaf children to speak is now being carefully studied by specialists at the University of Michigan.

All the "miracles" of telephone engineers have come from the study of electric waves, which are among the most sensitive and temperamental things in the Universe.

Electric waves used in the telephone have only about one-millionth of the power that lights the electric lamp beside your chair. Nursing these nebulous waves along, delivering them strong and clear over thousands of miles of wire or through the air as radio waves, passing them safely through millions of connections and relays, and doing it always better and faster, is the main task of Bell Laboratories men.

In doing that job, they have reached out through 93 million miles of space to study the sunspot cycle and to learn to forecast the showers of electrified particles from the sun that periodically disrupt radiotelephone channels across the oceans. They have probed into the mysteries of how electrons, dancing inside the atoms of a copper wire, transmit the energy of speech from one end of the wire to the other.

Bell men's problems are never-ending and ever new.

Inside the mouthpiece of your telephone, for instance, behind the little holes that you talk into, a thin diaphragm of duralumin is vibrated by the energy of your voice. To protect it from rust-producing moisture, it used to be covered with a membrane of oiled silk. But cigarette and cigar ash, mixed with the moisture of people's breath, got inside and made a caustic deposit that ruined the oiled silk. So Bell men worked up a synthetic rubberized protector that is impervious to that caustic action.

They've developed a paint for telephone operators' chairs that won't snag the girls' stockings or rub off on them.

They've raised termites to find out what these pernicious insects *don't* like to eat, to help find a preservative for telephone poles in termite-infested country. In the process they discovered that termites will pine away, refuse food, and even digest themselves if their colony is disturbed. Maybe that will be some comfort to you if you have termite trouble!

They have a movie camera in which the film runs 70 miles per hour, taking up to 8,000 pictures a second, to slow down the movement of fast-acting automatic switches to see just how they work, or why they don't. Those cameras, incidentally, were used to photograph still-secret details of the atom bomb tests at Bikini Atoll.

You've wished sometimes (except when caught in the bath!) for a television set beside your telephone to let you see the person on the other end. Bell scientists 20 years ago built such a combination and had it working for a while between two buildings in New York. But installing it for general use today would

**Metal Is Rolled to Calling-card Thinness**

Walter S. Gifford (right), President of the American Telephone and Telegraph Company, watches while permalloy is fed into a machine which compresses it into strips 14/1000 of an inch thick. These are used in relays that are the heart of the telephone dial system.

be too costly to be practicable. Bell men, too, put on the first television demonstration between New York and Washington in 1927.

Constantly delving into endless secrets, solving countless problems, searching for knowledge that will be useful in ways as yet unknown, Bell Laboratories is typical of the many great industrial research institutions of the United States which have helped give this country its high standard of living and its leadership in many fields of science and technology.

**Coal Grains Make Your Telephone Work**

To tell all the things that Bell men do would take up volumes of this MAGAZINE, but a few examples will give you an idea.

Consider the coal in your telephone. Yes, coal—about 50,000 finely crushed granules of it, in a pea-sized box just behind the diaphragm inside the mouthpiece (Plate IV). Through these bits of coal flows the current that carries your voice over the wire.

Coal is used because it's carbon, and carbon is not only a good conductor but quite elastic. As your voice vibrates the diaphragm, pressure of the granules against each other changes the area where they touch. That varies its resistance to the current passing through, and translates your voice waves into waves of electric current.

But that coal, though it is specially selected from only a few deep mines in Pennsylvania, has its drawbacks. Probably you're satisfied with the way it works, but the Bell scientists are not. It gradually deteriorates, and replacing it costs around $250,000 a year. More important, the tiny lumps are rough and uneven, providing a rather variable contact. Round grains, like tiny balls, would work better.

You can't make coal that way, though; so the Bell scientists have found a way to make tiny balls out of silica sand, so small that even under a microscope they look smaller than BB shot. Heated methane gas is passed over the globules. It deposits on them a layer of carbon only one-millionth of an inch thick.

That thin layer of carbon works just as well as the solid carbon of the little lumps of coal, and, unlike real coal, its quality can be controlled and never varies. Eventually that "synthetic coal" may be in your telephone, making it work even better than now, and lasting longer, too.

When you talk today by telephone between some large cities, your conversation may travel with several hundred others, all moving together inside the new "coaxial" cable (page 300). They all travel on currents of high frequency, each conversation using a different band of frequencies, or wave lengths, just as each station you get on your radio has its own band of wave lengths.

That combination of wave lengths, or frequencies, traveling over the cable is like the white light in a theater spotlight, containing within itself all the different colors — red, blue, green, etc. To throw a red light on the stage, you use a red filter which lets only the red rays pass through; a blue one for a blue light; etc.

Staff Photographer Willard D. Culver

**Styles Have Changed in Operators' Headsets Since 1880!**

Girl at the right, in a costume of 65 years ago, wears the "Gilliland harness," which weighed six and one-half pounds. The box contains the transmitter. Operator at the left wears the latest headset, weighing only five and six-tenths ounces. Transmitter remains before the mouth when the head is turned.

### Man-made Crystals Improve on Nature

You separate out single telephone conversations in the same way with electrical filters. Heart of each filter is one or more quartz crystals, each of which vibrates an unvarying number of times per second. The crystal filter lets through only the one conversation to which it is tuned. These crystals are made from a special grade of quartz found almost exclusively in Brazil.

That brings up the story of how Bell scientists actually "improved on Nature" and made artificial crystals better for some purposes than the natural Brazilian kind. These artificial crystals played a big part in helping to win World War II.

When German submarines began sinking Allied vessels wholesale, the Navy issued an urgent call for a device better than those then in use for locating submarines under water. Best way to locate a submerged submarine is to send out sound waves through the water which strike its hull and bounce back to their source. When converted into electrical waves, they reveal the distance and location of the submarine.

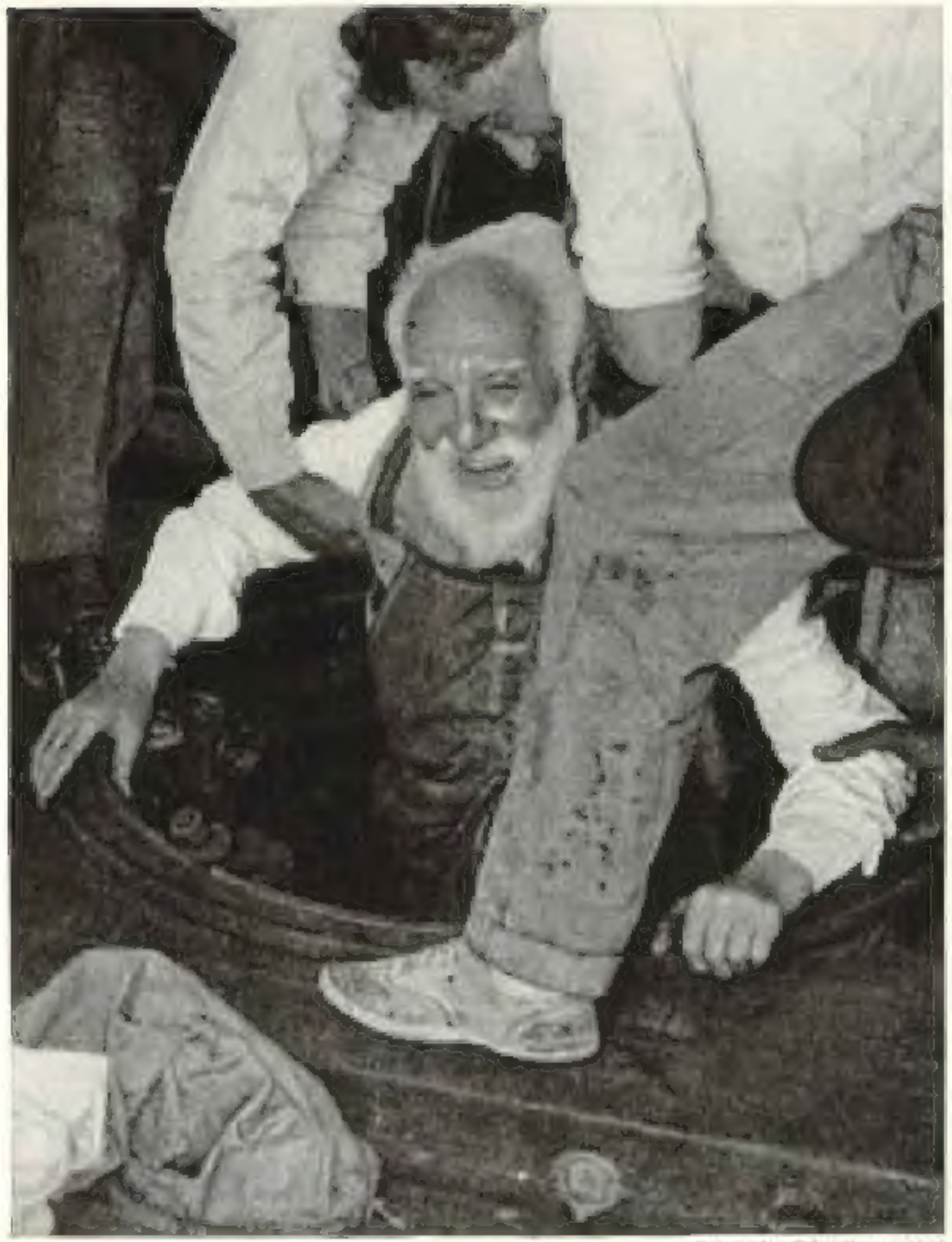
To convert the sound waves into electrical waves precisely enough to locate a submarine accurately, the best method is to use crystals which vibrate at a very precise frequency. Crystals of natural quartz had some limitations for the purpose and also were scarce, and those two facts made it essential to find a better way to do the job.

Bell men saved the day with artificial crystals. If you put a little water containing salt in a saucer and let it sit in the sun, the water

Frederick Gutekunst

**At the Telephone's Fortieth Birthday Party, 800 National Geographic Members Took Voice Voyages to the Four Corners of the U. S.**

For the first time in history, through headphones each guest heard Pacific rollers breaking on California beaches; Prime Minister Sir Robert Borden in Ottawa sent heartiest greetings from Canada; and Brig. Gen. John J. Pershing, commanding the Mexican Expeditionary Forces, reported from El Paso on the Rio Grande, "All's quiet on the border." The black "box" on the table was an exact duplicate of the first Bell telephone. At the speaker's table on this great occasion, March 7, 1916, in Washington, D. C., are, left to right: Mrs. Lane; Thomas A. Watson (who built the first telephone and to whom Bell addressed his first words, Plate I); Gilbert Grosvenor, Editor and Director National Geographic Society; Maj. Gen. Hugh L. Scott, Chief of Staff and Actg. Sec. of War; John J. Carty, Chief of Eng. Staff, Am. Tel. and Tel. Co.; Dr. Alexander Graham Bell; Theodore N. Vail, President Am. Tel. and Tel. Co.; Sec. of Interior Franklin K. Lane; O. H. Tittmann, President National Geographic Society; Sec. of Navy Josephus Daniels; U. N. Bethell; Postmaster General Albert S. Burleson; Rear Adm. Colby M. Chester, USN; N. C. Kingsbury; Mrs. Burleson; and Sen. Joseph E. Ransdell. In the foreground, extreme left corner, Prof. Edwin A. Grosvenor, of Amherst College, and Theodore W. Noyes, 38 years Editor, Washington *Evening Star*. At extreme right, Harvey W. Wiley, father of pure food laws.



Submarine Film Corporation

**Up from Davy Jones's Locker Comes a Smiling Dr. Bell**

On his visit to Nassau in the Bahamas, the 75-year-old inventor descended in a submarine tube to study sea life on a coral reef. His friend, Charles Williamson, originated this device, a flexible tube with an observation chamber at the bottom.

Herbert Gehringer

**The Inventor Examines One of His Twin-bearing Sheep**

Since ewes usually bear a single lamb each year, Dr. Bell increased their yield to help farmers of Nova Scotia. Working for 35 years, he developed a flock in which ewes bore twins and triplets half the time. Dr. Wilfred Grenfell, Labrador medical missionary, in center.

**Dr. Bell's Prediction Comes True. He Talks to a Man "In a Distant Place"**

The inventor of the telephone, in 1892, opens long-distance service between New York and Chicago over 800 miles of open wire line. Only 14 years before, in 1878, he had predicted that some day "a man in one part of the country may communicate by word of mouth with another in a distant place." Today all New York-Chicago connections are in underground cable, also forecast by Bell. The man with full beard is John E. Hudson, then President of the Bell Telephone Company.

evaporates and you have some salt crystals left in the dish.

The Bell men began the same way, but instead of ordinary salt they used a chemical solution that contained ammonia, hydrogen, and phosphoric acid. They evaporated a little of it, and what they had left was a small crystal. This was too rough and imperfect to use in submarine detectors, but it served as a "seed" to build larger and better crystals.

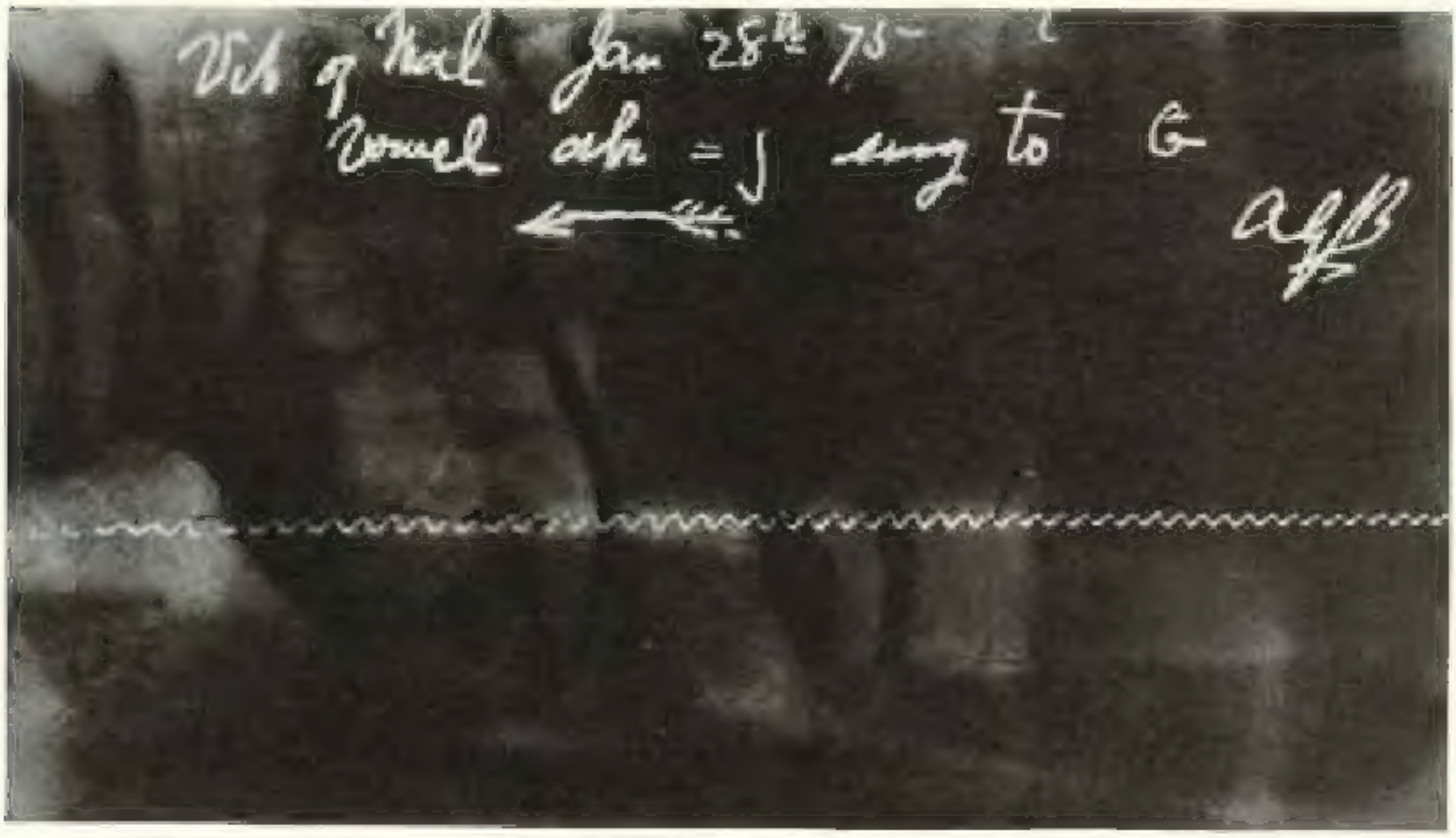
If you revolve a crystal seed in a tank full of the chemical solution, more of the chemicals will come out of the solution and deposit on the seed (Plates XII and XIII). Gradually a large, clear synthetic crystal is built up. When it's large enough you take it out, cut off the good part, and use the seed over again to build another crystal.

Those synthetic crystals are not quartz, but they are built in almost the same way that Nature makes quartz crystals. But Nature takes uncounted thousands of years, while the scientists do it in days.

More than a million of those synthetic crystals went to war. Built into the Navy's famous submarine detector known as "sonar"

**In This Improvised Laboratory Alexander Graham Bell Invented the Telephone**

The painting by W. A. Rogers shows one of the rooms used by Bell at 5 Exeter Place, Boston, Massachusetts, as it appeared in March, 1877. Dr. Bell is shown discussing a telephone instrument with his assistant, Thomas A. Watson (left), in jest at his habit of working late. The picture of the owl was painted by Mabel Hubbard, Bell's fiancée. The first sentence transmitted by telephone was sent from this room.




**Singing into a Human Ear, Bell Recorded This Sound Wave on Smoked Glass**

Hoping to make photographs of sound-wave patterns to help teach his deaf pupils to speak, Bell secured a human ear through a friend, Dr. Clarence J. Blake, and attached a straw to it. When he sang into the ear, the straw recorded the vibrations of the eardrum on smoked glass. The wave pattern shown here is that of the vowel "Ah" sung to G, as indicated in the notation signed with Bell's initials (page 288).

Alexander Graham Bell (Right Top of Steps) First Taught American Deaf Children at Lexington School in Boston

[illegible]

Flight of an Experimental Wave-shaped Multicelled Kite Is Watched by Dr. Bell (Extreme Right) in July, 1948

Dr. Bell [illegible]

"Feb. 23, 1909. McCurdy Flew over Baddeck Bay In the *Silver Dart* About Half a Mile. First Flight of a Flying Machine in Canada"

[illegible]

A Picture of Concentration, Dr. Reid Stull's Performance of the HD-4's Hydroflaps as It Speeds Toward Huron—September, 1920

Lieut.—Comdr. Walter Lyon in HD-4 Roars Across Biddeck Bay at 1920 World-record Speed—71 Miles an Hour

Men Who Developed the Telephone Visit National Geographic Society, March 8, 1916

[illegible]

[illegible]

[illegible]

Dr. Bell Leaves a Hand in Hacking Down One of His Big Manufacturing Kites

[illegible] United L.L. Thomas E. [illegible] of the four sides [illegible] each movable [illegible] Dr. Bell experimented with [illegible] at his summer home at Baddeck, seeking to [illegible] of flight. A grandson, Melville Bell Grosvenor, aids in the investigation.

Not long ago a man riding in an automobile in Washington, D. C., picked up a telephone on the dashboard and talked to his wife in England, learning, incidentally, that their grandson had had his first tooth.

That was a demonstration of the new mobile radiotelephone service which is rapidly being put into use in large cities and on major highway routes in this country (Plate III). With this service you have in your car a telephone with its own number.

If you are a salesman, for instance, out around town in your car, the boss may want to tell you right away about a new good prospect for a sale. He merely calls your car telephone number, the call goes by wire to a radiotelephone station, then through the air to your car. A bell rings and a light flashes on your dashboard. You pick up the phone and carry on a conversation. Later, if you want to call the boss to tell him you put over the deal, you can call him direct from the car.

If you're out on the road between New York and Philadelphia, the boss can get you by calling long distance, giving your car telephone number, and saying he thinks you're about 20 miles south of Newark. The toll operator routes the call through the radiotelephone station that is nearest to that locality. If you don't answer, she tries the next station on down the road.

You can see this system's usefulness for salesmen, police, doctors, buses, newspapers, delivery trucks, and public utility repair crews.

Telephoning to passengers or the engineer on a moving train also will be possible. Eventually, you may be able to talk this way from one train to another in different parts of the country or even of the world, and probably between passenger planes and the ground.

Just delivering your voice anywhere you want it sent, over the existing maze of American telephone wires, is a big enough job. To transmit a human voice over the telephone, you need first to know how the voice works and what it can do, and to make it heard at the other end you need to know how the ear works and what it can and cannot hear.

Alexander Graham Bell, in one of his early experiments, sang songs into a human ear obtained from a medical school. He attached a thin straw to the inner part of the ear, fixed at one end rested against a plate of smoked glass.

When he sang into the ear, the sound waves set up by his voice vibrated the eardrum, and the straw made wavy lines on the smoked glass. In this way he obtained a picture of sound waves that helped in his invention of the telephone. You can still see those old glass plates with the wavy lines on them, preserved at the Bell Laboratories (page 281).

Today Bell scientists are still experimenting with the human ear. Between 20 and 40 thousand nerve fibers connect the ear to the brain. These nerves, telling the brain what the ear hears, form the last link in the process of transmitting the voice over the telephone.

New knowledge of deafness and what to do about it also has come from these studies of the human ear. A device to measure the hearing of a whole roomful of school children at once was developed by Bell scientists.

The children listen to a series of numbers spoken with steadily diminishing loudness, and write them down as long as they can hear them. The last number written indicates the degree of the child's deafness, if any. These tests, now widely used in schools, have shown that one of every 15 American school children is handicapped in his school work by some degree of permanent or temporary deafness.

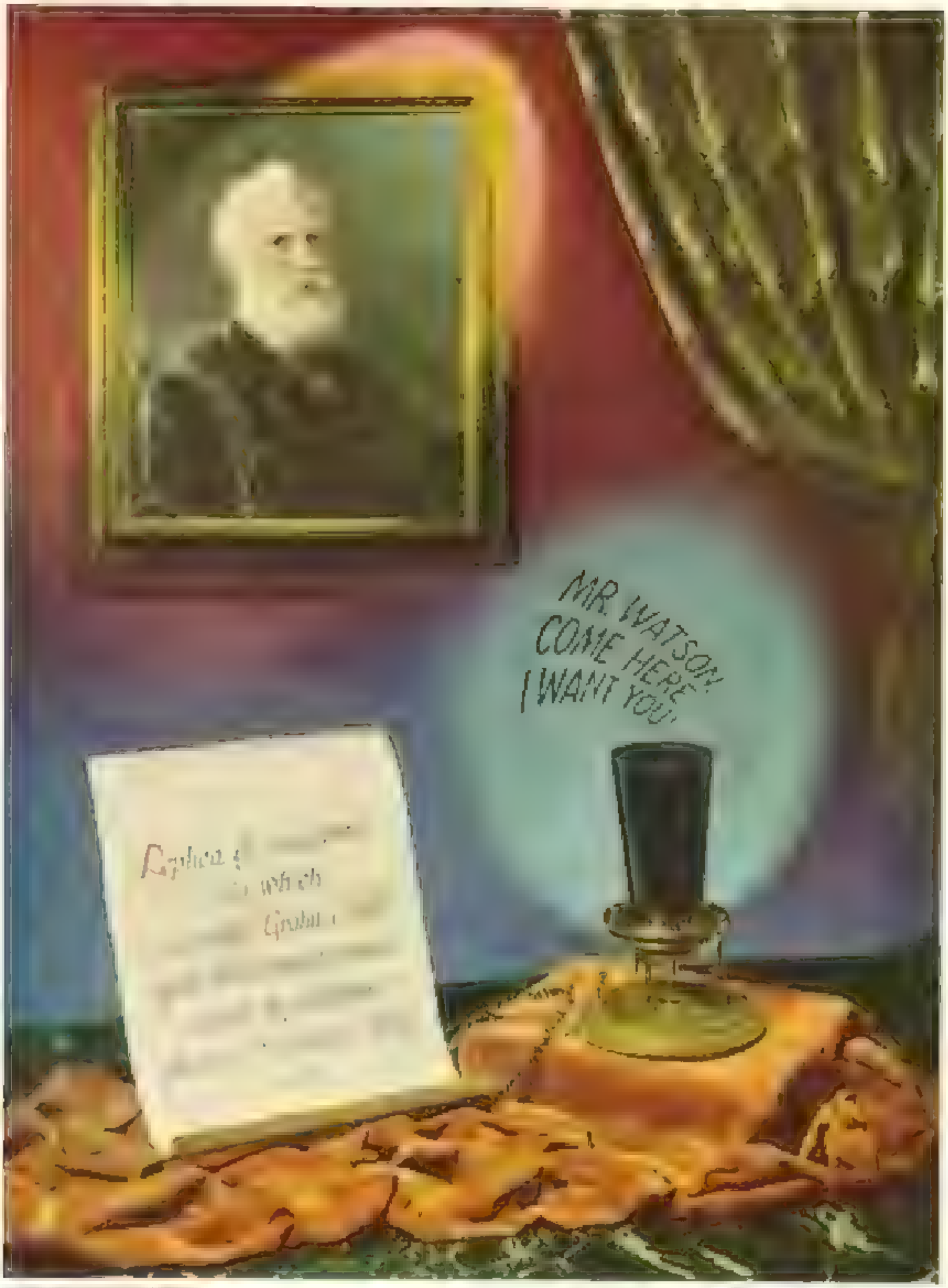
### One Person in 10 Is a Little Deaf

The hearing of more than half a million people was tested in the same way at the New York and San Francisco world's fairs of 1939-40, the first tests ever made of the hearing of a large cross section of the population. Results showed that one in every 10 persons is deaf to some degree, but that some people have supernormal hearing.

Speaking, of course, is just as important as hearing in the telephone system. It begins with the larynx, which contains the vocal cords. They really are not cords but two curtainlike membranes, in your throat behind your Adam's apple, that vibrate when you talk.

Seeking to learn how the vocal cords work, to see if the telephone transmitter was properly designed to handle the sounds that the cords give out, Bell Laboratories scientists took the first high-speed movies ever made of the vocal cords in action (Plate II). People used to think that the cords vibrated like a banjo string, but the movies, run in slow motion, showed that they really have a sort of wavelike action, somewhat like clothes flapping on the line on a windy day.

From the movies they learned, too, that sound comes from the vocal cords in puffs. Since the telephone was already designed to handle this type of energy properly, no changes were needed. The movies revealed that a person with a well-trained voice keeps his vocal cords closed until air pressure is built up in the chest and expelled strongly. In a person with an untrained voice the cords are open most of the time.




2,000 Scientists Today Carry on the Work of Alexander Graham Bell, Inventor of the Telephone.

**While She Says "Mah-ah," He Sends Fast Movies of Her Vocal Cords in Action to Learn How the Voice Works**

Strong [illegible] Dr. [illegible] [illegible] Bell [illegible] vocal cords [illegible] the [illegible] of the [illegible] sound [illegible] the [illegible] [illegible]

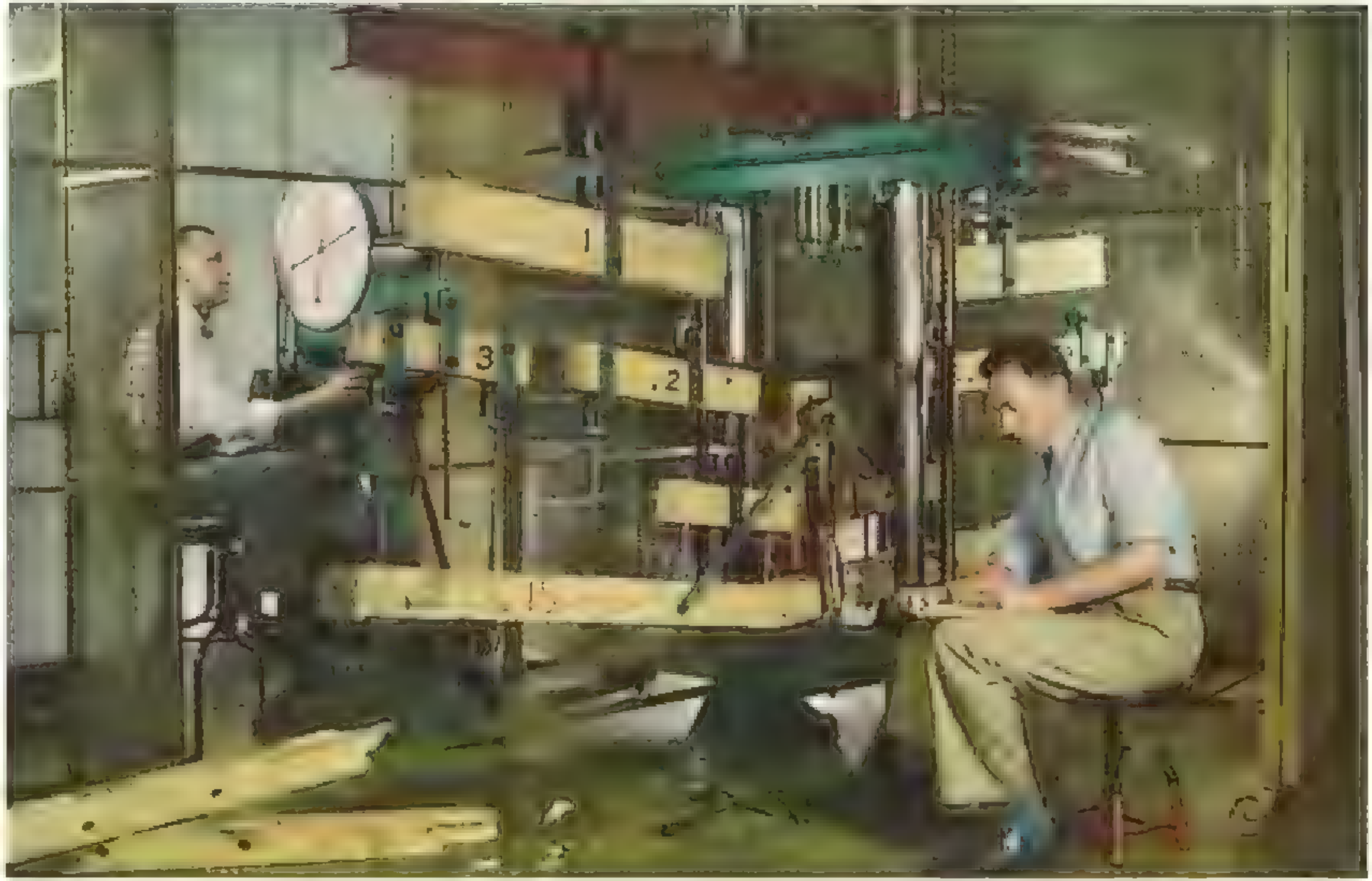
"Having a Lovely Drive, Dear. We'll Be Home by Seven"

She Needs a Microscope to Advise Tony Vacuum Tube Parts

Telephone Pole Diseases Get Expert Study in Bell Laboratories' "Clinic"

Sights Equal Grapples, Used in Every Telephone Cover Girls' Playing Card Spot


New Metal for Use in Telephone Magnets is Poured from "Self-heating" Furnace



How Much Weight from Ice-laden Wires Will Break a Crossarm on a Pole? Hydraulic Machine Gives the Answer

Overtone Her Head Shape Makes Her Headset Fit Better

Bells That Ring Your Telephone Are Tuned to Meet Your Needs

New "Cleveland" Antennas for FM Broadcasting Cuts Power Waste of Radio Energy

[illegible] designed by the Laboratories for the new [illegible] and are free of static. From the antennas, radio [illegible]

Women's vocal cords are shorter than men's, and this is the reason why their voices are higher-pitched. Opera singers have had their vocal cords photographed by the Bell people in efforts to improve their performance. Doctors are using the high-speed camera to photograph diseased vocal cords.

"First step in making a telephone work right is putting your voice into it," one of the Bell engineers told me. "That's not as simple as it seems. When you talk, the sound waves resonate in the cavities of your mouth and throat and are shaped by your teeth, tongue, palate, and lips.

"About half the sounds you utter are made within the mouth, the other half coming from the vocal cords. When the sounds come out of your mouth, they billow and eddy all around your head, besides traveling straight forward.

"To find out how the voice behaves and how it is transmitted, we use an artificial voice which reproduces all typical voice tones (Plate IX). We found that our efforts to make voices more understandable over the telephone tended to reduce naturalness, and so we try to strike a happy medium. The human voice ranges over about five or six octaves, but not more than about four octaves need to be transmitted over the telephone for good hearing. To transmit the other octaves would be unnecessarily expensive and complicated.

### Artificial Voices at Work

"Incidentally, we have artificial voices working regularly as part of the telephone system. Sometimes from a dial telephone you may call a number which is in an exchange where operators handle the calls; so, when you turn the dial, it starts an artificial voice speaking, and this repeats aloud in the operator's head-set the number you have dialed. This is done with numbers recorded on sound movie film, and the dial system selects the numbers to be "played."

"To do its job well, the telephone mouthpiece should be right in front of the mouth, and the receiver end of the handset should be right by your ear. That means the handset has to be just about the proper length to reach from the average ear to the average mouth. The connecting piece has to fit around the face. We measured hundreds of human heads, big and little, fat and thin, male and female, to design a handset that fits them all.

"How many times have you dropped your telephone on the floor? How many times in a year do you hang it down on the hook when you finish talking or get a busy signal? Not long ago a woman in Washington, D. C., hit a holdup man on the head with her telephone when he tried to stop her from calling the police. It didn't break.

"We make the handset tough by baking the plastic with a chemical process that generates heat inside the material, heating it equally all the way through. On a testing machine we can hang down a handset on the hook enough times in 24 hours to duplicate the wear it gets in 40 years of use" (page 314).

Why is it hard to understand women? That, too, is a problem for Bell Laboratories men. It's not a matter of "advice to the lovelorn" or trying to figure why ladies change their minds. It's why women are somewhat harder to understand over the telephone than men.

The answer is that higher-pitched female voices disturb the inner membrane of the ear in only half as many places as the lower voices of men. The higher frequencies of their voice tones are not heard because the ear is less sensitive to them. Yet the telephone must overcome this handicap as well as possible.

When you telephone today in any good-sized city, your voice is directed to its destination by a mechanical brain that works faster and in many ways better than any human brain ever could (Plate X). This "brain" is part of the "dial system," developed in its present form by Bell Laboratories engineers.

When you pick up the telephone and start to turn the dial wheel, the "brain" goes into action. First it notes the number you're calling, which is, say, Elmhurst 6-6452. Then it runs through the maze of telephone channels for a clear route from your own exchange to Elmhurst. It sets controls to keep that route clear, connects you to Elmhurst, finds the terminal of the 6452 line, connects you to it, and then drops out to handle another call, all in a matter of seconds.

If in setting up a call the "brain" runs into trouble in getting through, it turns on a set of lights to show where the trouble is and rings a bell in the wire chief's office.

### Relays Run the Dial "Brain"

Electrical relays play a large part in making the dial "brain" work. A relay may have as many as 60 electrical contacts which can open and close much as you open and close your hands and fingers. Part of each relay is an electromagnet made of a coil of wire wound on an iron core. When current flows through the coil of wire, the iron becomes a magnet and pulls the "thumbs and fingers" of the relay together. Current then can flow through and on to another relay, where it activates another magnet, thus closing another contact; and so on.

**No Man Left the Ground to Build Dr. Bell's Tetrahedral Tower at Baddeck**

[illegible]

When all the relays between you and the [illegible] you are calling are closed, the current [illegible] the wire [illegible] When you hang up, the current [illegible]

[illegible]

[illegible] relay fails to [illegible] or to spring [illegible] when the call is ended, or if the [illegible] contacts do not touch properly or are [illegible]

Relay [illegible] are made of [illegible] [illegible] and the current [illegible] [illegible] and [illegible]

[illegible] supplies must be [illegible] So Bell [illegible] developed a [illegible] of platinum [illegible] [illegible] than platinum.

[illegible]

[illegible] this kind of travel [illegible] the rooms where [illegible]

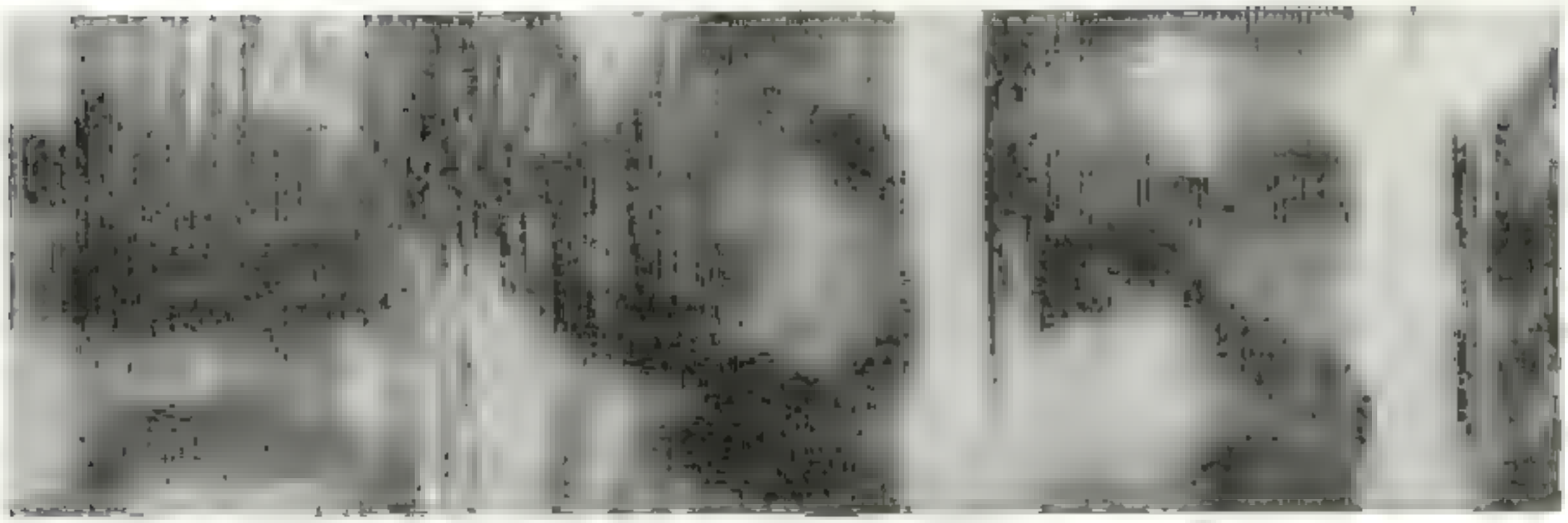
As a further safeguard contacts now are [illegible] in twin arrangements so that if dirt

**Dr. Pell Devised a Concrete "Mulberry" Like Those Used in the Normandy Invasion**

[illegible]

**In Position, the Caisson Is Sunk by Pulling a Plug in Its Wooden Bottom**

[illegible]



N A S H I N A L G E O G R A

In "Visible Speech," the Words "National Geographic Society" Take This Form

With an apparatus developed by Bell Telephone Laboratories, spoken words are transformed into [illegible] and shadows of varying shape and intensity which [illegible] of the patterns made by the short "A" sounds in "[illegible]" and "[illegible]." Moreover, [illegible] these also can be [illegible]

spoils the working of one pair, the other can handle the entire load of current. By cutting down the size of contacts, the cost of the twin arrangement has been made less than that of the former single contacts.

Today the dial brain is even handling many long-distance calls. A man in Philadelphia calling a Richmond, Virginia, number, gives the number to the Philadelphia toll operator. She dials a voice number that connects her with Richmond and then dials the Richmond number direct from Philadelphia. This method is already in use in several large cities and eventually will be extended over the whole United States.

### Giving Your Voice a Boost

Electrical energy rapidly dies away as it travels along a wire, and the smaller the wire or the higher the frequency of the current, the faster it dies. In some cases it may die away to one millionth of its starting energy in only seven or eight miles! In Alexander Graham Bell's day people used to speak loudly to overcome this loss on local calls, but on a transcontinental call that wouldn't help.

In old times they used wire as thick as a pencil to cut down the loss, but with the number of telephone lines in [illegible] such wire would be outrageously costly. Bell Laboratories men overcame that hurdle with the vacuum tube amplifier, or repeater, which in effect takes the faint dying whisper of your speech and turns it into a mighty shout that carries as far as the next amplifier.

On a typical New York to San Francisco call it takes about 180 repeaters, spaced every 16 miles, to boost your voice along, like a series of men on mountaintops, each one hearing the faint call of the man to the east and bellowing it on to the next man to the west.

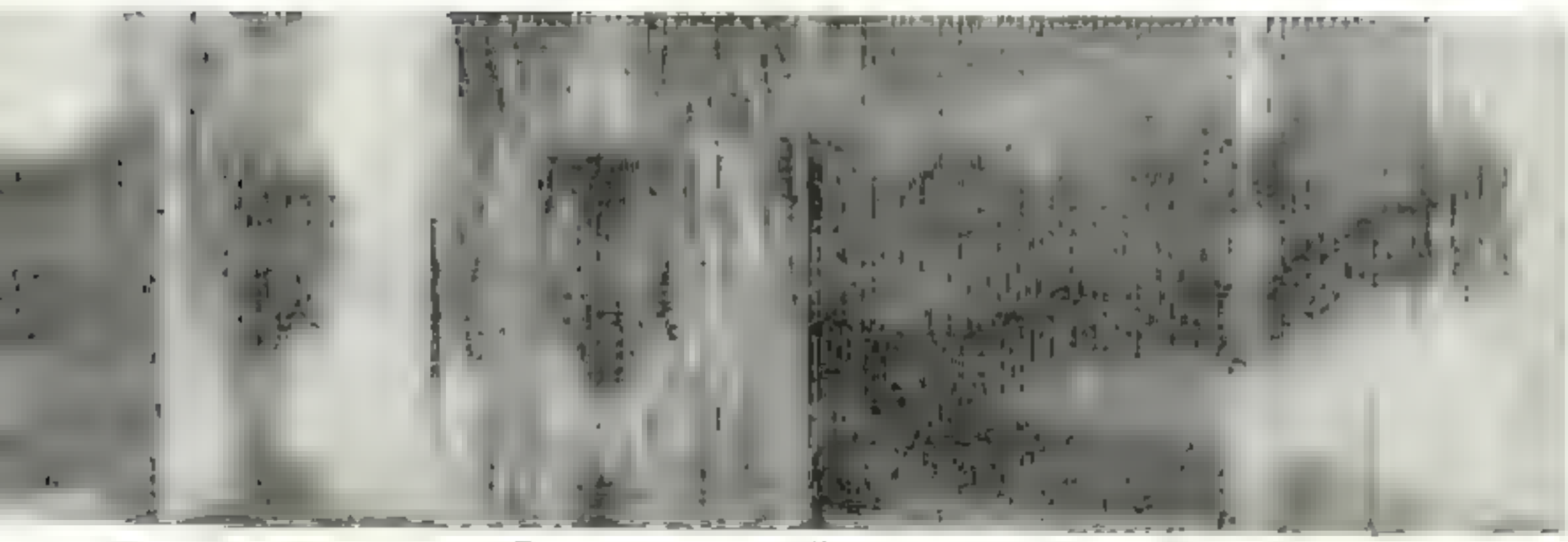
You must not let the voice's energy die away too much before amplifying it, however, for then it gets fainter than the noise of the electrons eternally dancing inside the circuits which carry your voice. Then, when you amplify, you amplify the noise, and the voice is lost in the vast by magnified roar of those dancing electrons, which otherwise no human ear ever hears.

Amazing as it may seem, on a cross-country call your own echo back along the wire from the other end of the line, a real transcontinental echo. Even though your voice travels thousands of miles a second along a wire, there is a sufficient time lag so that the man on the other end hears both you and your echo, a kind of confusing double talk. Bell men finally licked the echo with a device that stops it from returning while you're talking.

Ever since Alexander Graham Bell telephoned his first sentence over a wire between two rooms in 1876, telephone talk has traveled over ordinary parallel wires. But today such wires cannot do the whole job.

Bell scientists are developing brand-new ways of transmitting your voice. One of them is the new coaxial cable, consisting of several hollow tubes with a single thick wire inside each tube. This cable is already in service between a number of large cities and is being extended to cross the continent.

Still other ways to transmit your voice, without using wires at all, also are being



P I K S Ō S Ī F T Ī

**This Invention May Help the Totally Deaf to Speak More Clearly**

Many people who have been deaf from birth or early childhood do not speak well because they cannot hear the correct pronunciation of words. With "[illegible]" they can compare patterns made by their [illegible] of correctly pronounced words and [illegible] speech. In a similar way the device can [illegible] pronunciation of foreign languages [illegible].

[illegible] Bell men. They are experimenting with very short electric waves vibrating billions of times per second. Such waves won't stay on wires. They must either be shot off into space as radio waves or captured and guided along the inside of a hollow conductor or pipe.

Some day these extremely short waves may be carrying hundreds or even thousands of telephone conversations at the same time, each on its own wave length, without interfering with each other, over a single electrical pathway.

Television, too, is coming more and more to the fore. Television can be broadcast through the air only a few miles around each broadcasting station. To travel any distance it must be carried over some kind of channel or [illegible], and the telephone system provides a network to do this (Plate XV).

But, to transmit a television picture, you must transmit almost instantaneously all the degrees of light, shadow, and perhaps color in each of several hundred thousand different parts of the picture, and do it all over again [illegible] times each second. It takes a broad band of frequencies to do this job, and such a broad band cannot travel more than a short distance over ordinary telephone wires.

### Telephoning Without Wires

Various kinds of telephone pathways, which can carry many telephone conversations at once, and television programs as well, are coming into use. One is the coaxial cable, already mentioned, with its hollow tubes or pipes with a thick wire inside [illegible]

[illegible] a cable, using six different tubes at once, you can send 1,000 telephone conversations and several television programs, all at the same time.

Another new kind of telephone pathway is radio-relay, which uses a tight, straight, pencil-shaped beam of very short radio waves instead of wires or cables. These waves are largely free from static.

Bell engineers see the time when many hundreds of telephone conversations or as many as half a dozen or more television programs may be sent over this beam at the same time.

Radio-relay uses short radio waves that travel in straight lines and, unlike longer waves used in broadcasting, do not follow around the curvature of the earth. Beyond the horizon these short waves go off into space, so, in order to transmit them any distance along the earth's surface, they must be picked up at a line of sight distance on the horizon and relayed on again to the next horizon. Thus they move in a series of short jumps between towers on mountaintops or other high points.

Radio-relay is now being installed by Bell engineers between New York and Boston. A radio-relay network eventually [illegible] all over the country, supplementing long-distance telephone cables.

Still another new kind of telephone pathway, a revolutionary new way of transmitting electricity, is the "wave guide," which is really just a hollow pipe. Electric waves travel through it like sound waves through a speaking tube.

It can handle very short waves that would

**Alexander Graham Bell with Three of His Grandchildren on Cape Breton Island**

[illegible]

**In a Characteristic Pose, Dr. Bell Plays with a Grandson**

[illegible] at Baddeck, Nova Scotia, the inventor entertains the boy by [illegible] hopping his knees suddenly. Dr. Bell is survived today by two daughters, Mrs. Bert Grosvenor and Mrs. David Fairchild, nine grandchildren, and [illegible]

quickly die away in a wire so somehow, using such waves, it may be possible to send through the wave guide thousands of telephone conversations at one time and many television programs.

Some [illegible] be used for long-distance telephoning, supplementing present cables, so that your voice would be "piped" to its destination instead of "wired."

As electric waves come out of the end of a wave guide, they can be focused by a special metal lens so that they form a narrow, light jet or beam, just as a glass lens focuses a searchlight beam. You can aim that beam to hit something, or move it around to find something, as you would a searchlight beam.

### Talking over a Radio Beam

Such a beam is used in radio-relay telephoning and in radar. In radio-relay you can aim the radio beam to hit squarely a small 10-foot receiving antenna 50 miles away on the next mountain. [illegible] ships, or to locate other planes or ships in fog or darkness.

But wave guides, radio-relays, and coaxial cables are not much good unless you can amplify the waves that they carry. These waves, just like the waves that travel on wires, need a good strong boost every so often to help them on their way.

[illegible] experiments with a new way to [illegible] wave [illegible] vacuum tube, the "traveling wave tube." Short waves carrying your voice or television signals are fed in at one end of the tube and travel inside it through a coil of wire.

An electron gun at one end of the tube shoots a stream of powerful electrons down through the inside of the coil. Just as a wind blowing past ripples in a pond makes them into bigger waves, the electron "wind" gives a boost of energy to the electrical waves traveling through the coil, sending them on with new power.

Other Bell Laboratories men, meanwhile [illegible] things perhaps easier to understand such as finding how tree branches rub insulation off wires and how to make insulators for telephone poles that won't break when small boys throw rocks at them. Such things may happen right in your own yard, a little closer to home than the mysteries of the electron.

On a 100-acre "test farm" near [illegible]

New Jersey, is a dense grove of young birch trees among which are strung strands of "drop wire," the kind of wire that connects your telephone to the main line along the street. These little birches quiver and sway in the slightest breeze and their branches rub on the wire, to show whether they will rub through new tough kinds of insulation.

Even out in the open where no branches rub on it, insulation on a drop wire sometimes breaks down. Bell scientists found it was caused by ultraviolet light from the sun and ozone in the air causing a chemical reaction in the insulation. In the laboratory they made new kinds of insulation, bathed them in artificial ultraviolet light and man-made ozone until they had something that would stand up.

Only "crop" on the Bell test farm comes from a bed where various kinds of fungi grow in a low, moist, shady place. Driven into the ground in the bed are stakes made of samples of all kinds of wood, to test how fungi in the soil may cause the wood in telephone poles to rot and how various kinds of chemicals protect the wood from this attack.

On a near-by hill are set up rows of full-sized poles, some treated and some not, to see how they resist moisture and rot (Plate IV). Poles are impregnated with creosote under pressure to prevent rot, but Bell men found that fir poles are best treated when green, while poles of southern pine need to be seasoned first.

### Dancing Wires Make Trouble

Out in the West's "great open spaces," and in other exposed places, strong winds often set wires and overhead cables to swinging. As wires swing, they may make contact with one another, spoiling the transmission of telephone talk. Swinging cables may crack the protecting lead sheath.

This Jersey farm has machines to swing wire and cable artificially, just as the wind does it, over and over, millions of times, at the same time checking the number of hits when the "wind" blows at various speeds. From this Bell scientists figure how far apart to string wires so that they won't hit each other.

They've even taken movies of wires dancing in a high wind and then run them in slow motion. They slip sections of rubber hose over wires, too, to imitate the effect of icing, to see how much more leverage this gives the wind in swinging the wires and how much strain built up in this way is needed to break a wire.

Here, too, they bury samples of cable, conduit, and other things used under ground in the telephone system, to learn how they stand up and whether water will seep in. Once a neighboring farmer, seeing two scientists digging up a piece of cable about dark one evening, thought they were gangsters hiding a victim's body and called the State police!

Meanwhile, other Bell engineers are making plans for a new and better telephone link between America and Europe, a telephone cable under the Atlantic, first transoceanic telephone cable ever laid.

You can telephone across the Atlantic now, of course, by radio. Most of the time it works well enough. Radio waves that carry your voice travel in a series of bounces between the earth and the ionosphere, an electrified region of the upper air between 50 and 250 miles aloft.

But when sunspots are numerous, showers of electrified particles shoot off from the sun and disrupt the ionosphere. Instead of bouncing back down from it, the radiotelephone waves are absorbed in it or go on through and are lost in space. Sometimes, too, different components of the radio waves arrive at slightly different times, causing fading and distortion.

In a cable this wouldn't happen. You may ask, then, why a telephone cable wasn't laid long ago, since transatlantic telegraph cables have been in use since 1866. A telephone cable was designed, about 1930, but it could carry only one conversation at a time. Some radiotelephone circuits now are handling three at once to Europe.

To make an ocean telephone cable that can carry that many or more conversations at once, you need to put repeaters along it, the same as on long-distance cables on land, to pick up the dying power every so often and give it a new boost onward. On land the repeaters are above ground where you can get at them to make repairs and replace the tubes and batteries. You can't do that on the ocean bottom.

But now Bell men are working on a telephone repeater that fits inside a cable and can be wound on a cable drum without being damaged. They've designed a new, tiny, but long-lived vacuum tube for these repeaters which has every prospect of lasting many years inside the cable on the ocean bottom. They plan to send power out to the tubes from land along the cable itself and hope the cable will carry up to 30 conversations at once.

### Radar, Child of the Telephone

When the Nazi menace began to grow in Europe and while most Americans still were arguing about preparedness, scientists of the Bell Laboratories cooperating with the Army

**Insulated Vacuum Tubes, from Pencil to Coffee-cup Size, Work in the Telephone System**

[illegible]

**For Best Results, Hold Your Telephone Close to Your Lips**

[illegible]

Ever Try to Design a Nervous System? They're Doing It Here, with a Wire Harness for a Dial Telephone Apparatus

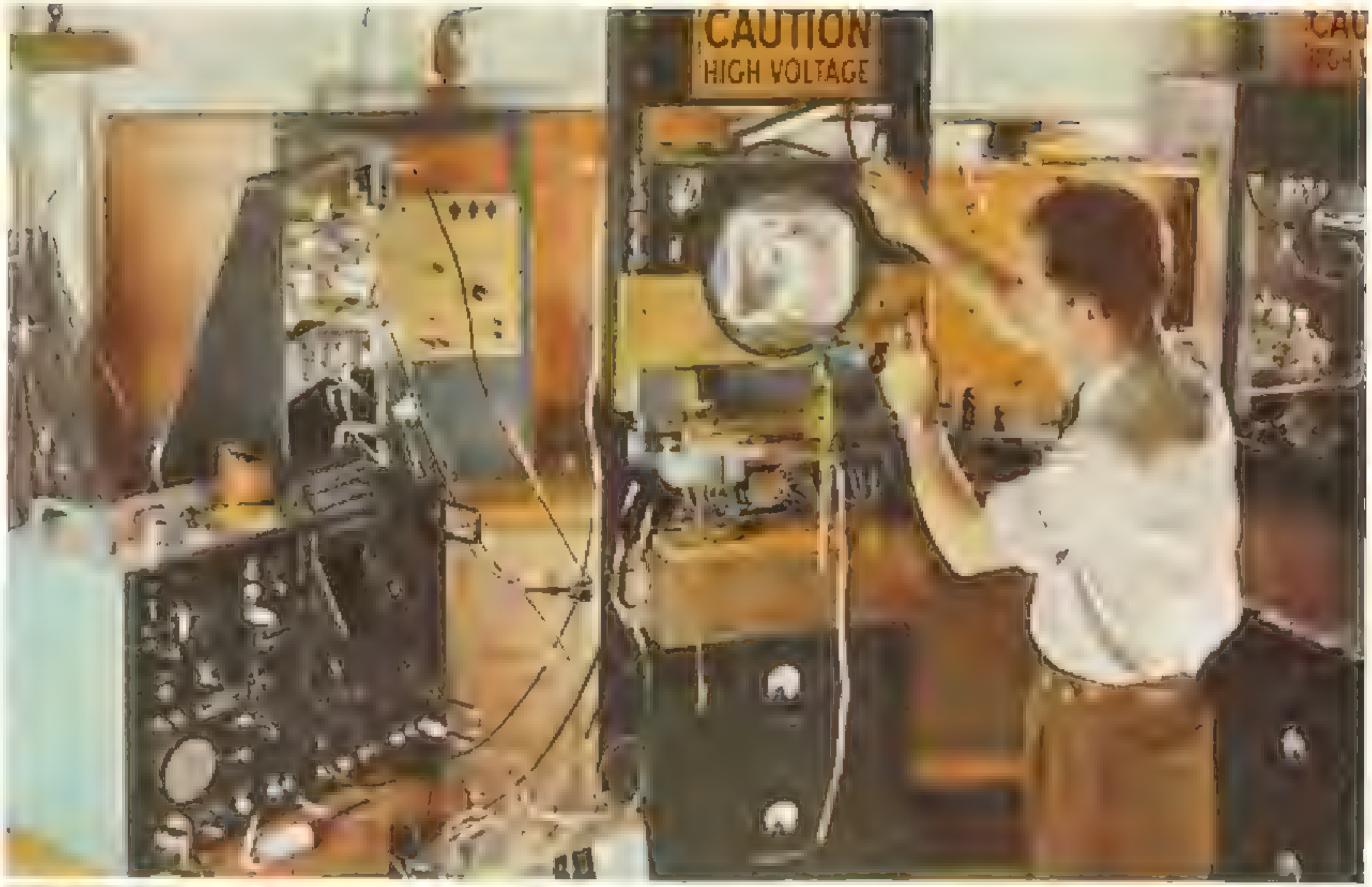
When She Dials Into Code, He Listens to See If the Signal Tells Clearly Whether It's a Nickel, Dime, or Quarter

**Man-made Crystals, Better in Some Ways than Natural Quartz, Are "Grown" in Chemical Tanks for Telephone Use**

[illegible]

Southern Crystals Used in "Sonar," Submarine-locating Device, Helped Defeat Germans in World War II

Guides with 'Walking Ears' Hear New Loudspeakers Designed to Reproduce Music and Voice with High Realism




Checking the Quality of Television Pictures Sent over Telephone Lines With Bell Use of His New Receiver

**This Giant Ear Sends Planes 100 Miles Away Come from Telephone Man's Design**

[illegible] the antenna which sends them out. Echoes [illegible] to the wave guide [illegible] the "scope." [illegible] the [illegible] to carbon [illegible] of the [illegible]

and Navy quietly began to get ready for war.

Since 1937 they had been experimenting with radar, but no one had found a way to generate short waves for the radar beam that would reflect back an accurate image of what it found, so that you could tell whether your radar had picked up a battleship or merchantman, a bomber or a fighter plane.

One day in 1940, long before Pearl Harbor, when England stood alone against the Germans, some English scientists brought to America a new kind of vacuum tube, the magnetron, which they had developed. It was a new, powerful generator to produce short waves that would bring back a more accurate image of what the searching radar beam found. Bell men, cooperating with the British, developed and improved the magnetron even further.

Radar was "right down Bell men's alley." Working in peacetime to improve the telephone, they had developed new gadgets and "know-how" that fitted into radar like pieces of a puzzle. Radar sets used many of the same things that Bell men had developed for the telephone system.

Vacuum tubes, used in radar to amplify the faint returning echo, were developed from similar tubes that amplify telephone signals. Saucer-shaped antennas, used to direct radar waves outward and catch them when they echoed back, are near kin to antennas used in telephoning by radio-relay (Plate XVI).

And the wave guide, already mentioned (page 301), which was used to carry the more sensitive types of radar waves from generating tube to antenna, grew out of Bell Laboratories' search for ways to transmit electric waves of very high frequency.

What radar did is well known. One U. S. warship, with radar-aimed guns, sank an enemy vessel eight miles away at night with only two salvos. At Anzio beachhead radar-equipped guns and planes broke up German pattern bombing. Radar-directed guns shot down all but three of 105 buzz bombs launched one day against London.

Radar in America was jointly developed by Bell Laboratories, the Government's Radiation Laboratory at Massachusetts Institute of Technology, the Naval Research Laboratory, the Army Signal Corps Laboratory, and other Government, industrial, and university laboratories.

All cooperated fully, and, together with British scientists, they gave America and her Allies radar sets better than the enemy ever had. Undoubtedly radar greatly shortened the war and saved countless lives.

When the Germans invaded France and the Low Countries, nothing seemed to be able to stop their air force. Antiaircraft fire was not much more accurate than it had been in World War I, when it took an average of 17,000 shots even to hit a hostile aircraft.

One Bell scientist, who like many others had been worrying about the Germans' successes, happened to be working on a potentiometer, or voltage-measuring device, used in connection with sending currents through long-distance telephone cables.

### Scientist's Dream Helps Win the War

One night this scientist had a dream. In the dream he saw a potentiometer mounted on the trunnion of an antiaircraft gun, and the gun was automatically "tracking" or following the flight of an airplane.

Unlike most dreams, this one stayed with him. When he woke up he jotted it down, and in this way was born the idea of the amazing electrical gun director, which gave American and British antiaircraft guns almost unbelievable accuracy. It was developed entirely by Bell Laboratories men, based directly on work they did to improve the telephone.

You can appreciate what the gun director had to do if you've ever shot ducks on the wing or tried to swat an elusive fly. You know how hard it is to figure in advance where the ducks or the fly are going to be the next second so that you can put your bird shot or your fly swatter in the right place at the right time.

Think how much bigger a job it is to fire an antiaircraft shell so that it comes near a plane flying 300 miles an hour, and with the fuse set to explode when it is near enough the plane to do some damage.

To score a hit you have to know the height of the plane, its speed and direction of flight, and the distance from the gun to the plane, which is constantly changing. You must know also the velocity of the shell leaving the gun, the speed and direction of the wind blowing against the shell, the temperature of the air, the pull of gravity on the shell, and the effect of air friction.

All this helps determine how far ahead of the plane to aim, so that shell and plane will meet. When you're shooting at a flock of ducks flying past, you may "lead" them with your gun by three or four yards; but you often "lead" a bomber formation with your antiaircraft guns by three or four miles!

When you have all the data, you have to perform an intricate mathematical calculation, and from the result you aim your gun. If you did this by ordinary methods, the planes would be long out of sight by the time you finished.

"Drop Test" Helps Make Handsets Hard to Break

[illegible] nearly six feet down a slide, this one bounces unharmed off an [illegible] in this type of test. Modern handsets are molded from plastic [illegible] chemically prehearted to increase strength (page 297).

But the Bell Laboratories men developed an electrical brain that does all this calculating in a fraction of a second. It works out how much fuse is left to burn before the plane's speed is so much for its height, so much for the shell's rate of fall of gravity, force of the wind, etc. It can even say that such a critical voltage is sufficient to turn the gun a little to the right or left or point its muzzle a little up or down.

When all the variables have entered perhaps a million times a second, that shell should be forced to the target. The electrical brain does all this pushing and pulling in a fraction of a second. It also operates the fuse setter, which adjusts the fuse on each shell to make it explode at just the right time.

### A Hit for Every 90 Shots

When the gun director went into action, American and British gunners shot down enemy planes with an average of only 90 shots [illegible] of ammunition. When the Germans started shooting buzz bombs at the great Allied base at Antwerp after the Normandy invasion, the gun director enabled our guns to shoot down all but a few of the 4,850 known to have been launched.

Best of all, the idea behind the gun director has great potential [illegible] peace as well as war. [illegible] it has become new knowledge of how to build new high-speed calculators to solve [illegible] problems that would take weeks for a man with paper and pencil. Perhaps, too, the [illegible] electrical brain also may find new uses in blind landing systems for airplanes and in control of the heavy airplane traffic around airports.

Another "secret weapon," ready for action when the war ended but never used, is a device that can detect a man lost by the hundreds of feet, a country a mile away, and locate fires and the classes of factories at night by the heat they radiate.

You can sweep this device around a darkened landscape and it will pick up the heat of anything, such as a man hidden in the bushes, that is only slightly warmer than its surroundings. From a high-flying plane it can indicate the pattern of a river by the difference in the heat radiated from land and water.

It [illegible] is built around the "thermistor," developed in peacetime by Bell Labora-

**Dr. Bell with One of His Water-distilling Devices**

[illegible]

[illegible] Bell Laboratories [illegible] special telephones [illegible] time. The [illegible] noise that [illegible] problems, presented with [illegible] to [illegible] anything else. And [illegible] with [illegible] life.

An [illegible] telephone that worked well in a toilet home or office was useless against the tremendous roar of hundreds of airplane [illegible] great humming roof or the deafening roar of a 4,000 horsepower engine inside the

[illegible] forces engineers to [illegible] set changes in temperature that cause variations in the loudness of speech transmitted over long distance telephone lines.

Thermistors are made of peculiar materials that conduct electricity well when warm and poorly when cold—just the opposite of most good conductors, such as copper. Tiny stacks of thermistor material are imbedded in a glass bead the size of a pinhead and connected to the amplifiers along the telephone line.

They are so sensitive to heat that they can detect variations in temperature as small as 1/1000 of a degree centigrade. As the air grows warmer or colder, the loss of power in the transmitted waves goes up or down. The thermistor regulates the amplifiers so that they keep the telephone signal [illegible] of the original loudness and conversations are passed on with invariable clarity.

### Mine that "Remembers"

Still another [illegible] weapon [illegible] made [illegible] that [illegible] possible [illegible] for [illegible] time. This [illegible] a large part in helping [illegible] Japan [illegible] of stray channels [illegible] accepted.

When a [illegible] ship passes over it [illegible] changes in the [illegible] of the mine. But its best feature was that it could [illegible] desired number of ships [illegible] then explode only the [illegible] the Japanese [illegible] clear of mines.

steel walls of a tank. It was often a matter of life and death for a pilot or tank driver to hear correctly a radiotelephone message above the roar of the motors in his ears, and equally vital that his own words spoken into the telephone transmitter should not be drowned out by the noise around him.

Shutting out surrounding noise in order to hear clearly was not so difficult. Bell scientists developed a soft rubber pad for the earpieces of telephone headsets which fitted tightly against the ears and cut down outside noise well enough to permit satisfactory hearing when there was no static on the radio. Such earpieces were used in aviators' helmets and in tank crews' headgear. But keeping unwanted noise out of the telephone transmitter or microphone was a tougher problem.

One solution was the throat microphone. Unlike ordinary telephones, in which a diaphragm picks up vibrations of the air set up by the voice, the throat "mike" had the diaphragm strapped tightly against the user's neck. When he spoke, the diaphragm picked up the vibrations set up by his voice in his throat walls, and other noise was largely shut out. But the throat microphone was not entirely satisfactory, because it did not transmit the speech sounds formed in the nose and mouth which are important for complete clarity (page 297).

To overcome this difficulty the Bell engineers built a microphone with a shield which covered the nose and mouth. This excluded outside noise and permitted the user to speak in the normal way with all the speech sounds transmitted. This type of microphone was built right into aviators' oxygen masks, which formed a noise shield in themselves.

Still another antinoise device was the lip microphone. It operated on the principle that if sounds strike both sides of a telephone diaphragm they will cancel out its vibrations and will not be transmitted; but if they strike only one side they will be. The diaphragm of the lip microphone is placed very close to the mouth. Surrounding noise still strikes both sides of it and cancels out, but the voice strikes only one side, and so the diaphragm vibrates and transmits the voice sounds. The lip mike was used in directing landing operations above the noise of battle and in persuading enemy troops to surrender.

Altogether, the Bell Laboratories worked on 1,200 military projects during the war, some of which are still so secret that Bell men don't even mention them to each other. Its staff was expanded from 5,000 to 8,000 men and women during wartime, and $150,000,000 was spent on war developments.

To train Army and Navy officers and men in the operation and maintenance of the new weapons developed there, the Laboratories operated a school in which more than 4,000 students received instruction. So numerous were the instruction books for these scientific weapons that during the war the Laboratories became, next to Uncle Sam, the Nation's largest book publisher in number of titles. What a far cry from the days when all a soldier needed to know was how to load and fire a squirrel rifle!

### Telephone By-products

From telephone research have come not only these many scientific weapons but also many other by-products for peacetime use which have helped make Bell Laboratories famous.

Bell men developed the orthophonic process of recording sound electrically, and "auditory perspective," a method of picking up the music of a symphony orchestra from several different points, to make it sound more natural when reproduced over loud-speakers. They made the first radiotelephones used on commercial air lines.

Bell men's research made possible new ways to measure accurately the noise in subways, traffic tunnels, airplanes and factories, and cut it down; and improvements in acoustics of auditoriums (Plate XIV).

Vitamin $B_1$, or thiamin, so essential to health and now put into many "vitamin-enriched" foods, was first produced in pure form by a Bell chemist in his spare time. Later he and his colleagues determined its chemical structure so that it could be made in vast quantities synthetically.

Prospects for the future seem endless.

"Most of the fellows on our staff are dreaming about 'day after tomorrow' even while they concentrate on telephone problems of today," one Bell engineer told me. "They're free to use their imaginations, to look far ahead, to think up new ideas. In their brains today are being born things that you and I haven't even imagined."

Walter S. Gifford, President of the American Telephone and Telegraph Co., in his 1946 annual report said: "The further we progress in the sciences underlying telephony, the greater becomes the promise of future benefits. The areas which we have under exploration are steadily expanding and the possibilities . . . of electrical communication seem to excel anything achieved in the past."

On His Diamond Jubilee Mohammed's Spectacled Heir Speaks English into a "Mike"

For Charity the Ex-Khan Stakes 243 Precious Pearls Against $1,100,000 in Jewels

**In His Brocaded Swivel Chair the Plump Aga Khan Sits Majestically and Matches Pounds Against Carats**

[illegible]

Guests Leave the Weighing Field [illegible] Ceremonial Veils. Bandstand [illegible] and Honor Guard Line Their Carpeted Way

European Flowers and Oriental Fruits, Stuffed Heads from the Exposition at Sion

Fazzed Tangerines Police Keep Order and Guard a Fabulous Diamond Treasure

Merchant Princes, Viziers, the Aga Khan, and Their Ladies Occupy Roadside Seats

A Weather Machine's Omen Drives Sixty Pilgrims as No Football Team Ever Moved a Packed Stadium

[illegible]

A Discovered Indian Beauty Ushers Suitables to Reserved Seats

[illegible]

A Princess of the Lalas Wears a Filmy Sari Trimmed with Jewels

Gentle Indaglia says [illegible] Plain. Tonar "Old Man of the Mountain" kept the [illegible]

# I Become a Bakhtiari

By Paul Edward Case

[illegible] Dr. [illegible] W. [illegible] under Iranian Government, Paul Edward Case was given a startling assignment to meet the chief of the Bakhtiari, a practically ungoverned tribe of central Iran, and to obtain their cooperation for construction of a road and a dam in their territory. He relates here, with the help of an Iranian business man, he accomplished his job.—The Editor

"THE PEOPLE of Isfahan can't manage [illegible] they now have," I said to my friend in Iran. "Dr. Wanner has told me to get packed and see the Chahar Lang chief. Wish me luck. Anything you can tell me will help."

This friend had been a long time in Iran and had excellent judgment about the management of the assignment I had at hand. We both had worked for more than a year among the Arab sheiks of the south while facilities were being improved for the shipment of war supplies to Russia through Iran.*

### A Mission Fraught with Danger

Because of the bad reputation of the Bakhtiari, this projected work had a strong atmosphere of adventure. All I knew was that there were two tribes, the Chahar Lang and the Haft Lang (Four Feet and Seven Feet).

On a bright Thursday in April I left Tehran in the cab of an American truck. We drove out the lower end of town into the Iran I love.

With many buildings of Western architecture, Tehran is European in appearance, but Iran outside the city is different in every way. I never feel that Tehran is really Iran (Plates I, III, IV, VI, VII, X).

The incessant horrid wing of the city eased off until none was heard. As we crossed over a railroad crossing bridge, farms stretched far ahead of us and on all sides. To my left was the shining gold dome of a small mosque.

Looking back toward the east, I saw the pure white peak of Demavend, rising 18,550 feet into a puffy cloud (map, page 329). Fragrance of clover was wafted to us across elm-shaded lanes and waterways. Wheat and barley grew in thousands of acres irrigated by irrigation ditches. Farmers followed their rude wooden plows, preparing fallow land for crops of grain, potatoes, and beans.

Many passing trucks had palm leaves from the south stuck in the radiator guards. Now and then the regular mounds of *qanat* lines stretched toward the mountains, from the base of which clear, cool water is brought to the barren desert by these underground tunnels—an irrigation system of great antiquity in Persia. Here real plant life (and, for that matter, all life) extends to the last irrigation ditch only; beyond are the thorny dwarf forms of the desert. Snow-covered mountains fringed our view on all sides.

By 6 p. m. we reached Qum.

I remained there overnight in the hotel erected by the late Shah to accommodate visiting buyers of the produce of the large weaving mill he also built near by. Qum is noted for a kind of glazed pottery, a form of molasses-like candy, and the magnificent shrine of Fatima, sister of Imam Reza. Long before the city is seen from the desert, its gold dome glistens in the sunlight (page 328).

To me, Qum is memorable also for delicious *kebab* (barbecued lamb).

After a breakfast of sour milk, flat pancake bread, fried eggs, and tea, I was off for Isfahan, handicraft center of Iran. An old king, Shah Abbas I, put his stamp on this city and left behind more real beauty than numerous heroic planners of other lands, ancient or modern. Some of the design motifs used in the Middle East have their origin in his patronage.

### An Iranian Bath Is Thorough

Since I did not know when my next bath would come, and virtually no hotels have bathing facilities, I went to one of the special *hammams*, or bathhouses, common to cities and villages.

I undressed in a small room, then entered an adjoining room of the same size to wash under a shower. Men came in to "massage" me, treating me first to a perfunctory stretching of arms and legs, and after that a vigorous rubbing of the complete body with a canvas mitten.

Surprisingly large rolls of skin and dirt were accumulated under the mitten even from those who think themselves clean. I suspected part of these rolls were from the mitten.

The massage finished, the attendant put the soap I had brought with me into a white cloth bag about the size of a salt bag. I had showered my raw body to wash away the scraped-

* See, in the National Geographic Magazine, "Lend-Lease and the Russian Victory," by Harvey Klemmer, October, 1945; "Mountain Tribes of Iran and Iraq," by Harold Lamb, March, 1946; "Iran in Wartime," by Jean N. Greely, August, 1943, and "Oil for New Persia," by the Baroness Ravensdale, September, 1939.

Iran Boasts Has Cheragh Ali, His Son, and His Rifle

[illegible] bears the name of an ancient Persian monarch. His father beheaded the author (page 353).

Upon returning to the hotel for dinner I met Mr. Sawa [illegible] famous work which we [illegible] in the Indian country. He [illegible] hint in his cat to Daran, where he was working and where he [illegible] on the Indian [illegible] of the Shiraz [illegible]

[illegible] was invitation for the 9-hour ride. I usually traveled by Army vehicle [illegible] the [illegible] Iran to the south — a [illegible] with [illegible] [illegible] (seen [illegible])

In Daran houses are [illegible]

Daran on the Edge of the Unknown

Daran, though a typical farm village of central Iran, has a telephone to Isfahan and twice-weekly bus service to Kermanshah (Iraq) [illegible] Iran to the south — a [illegible] with [illegible] [illegible] (seen [illegible])

In Daran houses are [illegible]

off dirt and was lying flat on a raised-tile, benchlike part of the floor. After dipping the [illegible] containing the soap into a pan of warm water, he [illegible] and blew it up [illegible] child inflates a toy balloon and squeezes out [illegible] bubbles of soap [illegible] was covered with a [illegible]

He [illegible] me thus three times [illegible] to shower and change into a [illegible] Fortunately, I had my own towel [illegible] being swathed in one [illegible] the groaning victim. [illegible] with [illegible] [illegible] to the dressing room.

[illegible] corner for defense [illegible] through the [illegible] grass [illegible] the east, which [illegible] towards [illegible] for the end of the [illegible]

The streets are twisting [illegible] to [illegible] passage [illegible] Would I got out of breath hurrying along the street [illegible] post a letter. I realized that the altitude [illegible] 7,000 feet. Trees had been [illegible] Isfahan. Here the buds were just [illegible] to break.

About thirty Iranian soldiers were quartered

[illegible] in the town and their horses were tied to rings in the mud wall of a house.

[illegible]

[illegible] Khan, who, he [illegible] said, was not far [illegible]

[illegible] miles from town and [illegible] each road, in fact. On the existing road [illegible] miles could travel [illegible]

### Reza Shah Tried to Harness Karun

We hoped to extend this road some [illegible] miles to a valley in the [illegible] mountains. There, more than three centuries ago, [illegible] following the [illegible] Karun, known [illegible] were now [illegible]. We were [illegible] the Karun River, which had [illegible] water [illegible] through [illegible] the water to the [illegible] road [illegible]

[illegible] Our part in the [illegible] was [illegible]

A [illegible] though it [illegible] would [illegible] to our operation. [illegible] tax collector [illegible] into Bakhtiari [illegible]

In Tehran people were [illegible] about our project. The [illegible] said would make a [illegible] to the Iranian Army to [illegible]

[illegible] that might fill [illegible] of ideas as to how I should [illegible] the Department [illegible] Department [illegible] to the [illegible] to [illegible] Bakhtiari. I wanted to keep [illegible] department [illegible] Salar and [illegible]

An Anthony Eden of Bakhtiari Land

[illegible]

Skyscraper Minarets and Golden Dome Guide Travelers to the Bokhtiari Country

[illegible]


Drawn by Herman E. Eastwood and Taylor F. Johnson

**Bakhtiari Tribesmen Inhabit the Rugged, Roadless Lands West of Isfahan**

Such a road was to be built, building a dam on the Karun River to tunnel surplus waters into the Zayandeh and irrigate thirsty farmlands to the east. By becoming a Bakhtiari, Mr. Cluse won his case. Completion of the project has been delayed, however. Some of the early Shahs started a similar scheme (page 325).

Early Sunday morning Sternal and I had breakfast at the home of his engineer, M. Matusevitch. Madame Matusevitch was an accomplished M. D. who with her husband had lived long in France and for some time in the Belgian Congo.

Here in Haft-Gol she treated the sick as a pastime, entirely on her own, and, I suspected, at Sternal's expense. She spoke French, Russian, Spanish, German, and Persian. To my delight her husband spoke English.

As we ate, patients came to squat at Madame's door to await her attention. Syphilis, tuberculosis, and other kinds of nasty infections predominated, as well as rheumatism. Some of the people had walked miles for the benefit of her service. She was told by old women and men that the wind brought their troubles.

### Doctor's Prescription—One Bath

From their appearance none ever bathed. Now and then even her experience failed her, and she prescribed a bath before she could continue beyond her first look.

A boy came this Sunday morning with a severe burn down his side from ear to knee. He was in great pain. The boy's aged father and mother swore he had received the burn from lightning two days before, but Madame's keen eye detected a hot water burn only a few hours old. Such made-up stories were common.

One of her greatest worries was the care her patients gave their wounds and sores at home. Often they would appear at later visits after her careful dressings, with bits of paper, sheepskin (wool side down), or sheep grease covering the sores they expected to heal. Through it all she showed a loving care and great competence.

Matusevitch proved to be ideally suited to the work in this section. With only hand labor available and crude tools in common use, it was most fortunate to have a man in charge who understood the problems involved.

Breakfast finished, Sternal, Matusevitch, and I got into Sternal's car and started for the Bakhtiari country. The first town was Bakhtiar, an hour away on a road across desert mountain slopes and through wheat fields farmed by Bakhtiari farmers. Beautiful flowers grew in the lure soil, still moist from the melting snows of the mountains. On our left

Twice Each Year the Nomadic Bakhtiari Scale the Snow-clad Zagros Mountains to Find Grass for Their Flocks

[illegible]

"American Khan" the Author, Is Impressed by the Bakhtiari

American and Persian Build a New Iran

was a 12,858-foot peak, glistening white in the sunshine.

At the top of the divide we looked down upon a broad valley of breath-taking beauty. Towering mountains edged its green fields, which were crisscrossed by irrigation ditches. I wished that I had a book to tell the names of the handsome plants that carpeted the land.

The sight of Bulamir around the bend of the valley brought me back to my work. Tall poplar trees and round-headed willows rose between mud houses crested with camel grass. To the right, higher up the hillside above the village, was an old fortlike structure badly broken down. To the left of the town, which had about 100 houses, was a larger, newer-looking building of two stories.

Winding along the horse-trail road, we drove across a brook to the big house, where a crowd of men stood around a large piece of red canvas spread out on the ground. They were erecting a tent for the summer use of Salar, one of whose four homes was at Bulamir.

As we drove up, two men of obvious importance separated from the group and approached us. They introduced themselves as Ali Murad Khan, head of Bulamir, and his younger brother, Cheragh Ali Khan, both brothers of Salar (page 326).

We were received with ceremony and escorted up one of the carved stone stairways which rise at each end of the front of the house. Leading the way, Ali Murad Khan drew aside at the steps to give his place to Sternal and me, an honor, I soon learned, of no small importance among the *Khans* (p. 339).

We went up the high steps—each riser was at least a foot high—to a wide porch overlooking the whole valley and several villages. At our feet a garden stretched inside the walled yard. We were ushered across the porch and through the French window-like doors of a large living room.

### Luxury Amid Bricks Without Straw

The outside of mud and sun-dried brick had hardly prepared us for the magnificent carpets, heavily upholstered chairs, hand-embroidered silk table scarfs, and—of all things—a radio. From pictures high on the walls the Shah and his beautiful Queen looked down on us, as did a handsome man in fancy brocade coat and large black mustache. Ali Murad told me later this was his father.

Likenesses of the King and Queen of England were in another frame, and a large map of Iran hung at eye level on a far wall. On the front wall was an oil painting of a farm girl walking a lane in a lovely rural countryside of England or America.

Tea was served us in glasses held in silver holders. Cheragh Ali Khan sat stiffly in one corner, while Ali Murad Khan obviously was keen to know what brought us. Sternal introduced our subject. Since he was an Iranian, his Persian was naturally far superior to the few badly mangled words I could muster.

### Tribesmen Keep Poker Faces

He addressed his talk to Ali Murad Khan, telling him that I was an American in the employ of the Iranian Government (eyebrows went up), an assistant to Dr. Wilson, who had visited here last year, and that I was here now to arrange with them the building of the road to Tang-i-Gazi, so many years in discussion. He himself, he said, was the contractor for the road, which he had begun at Dunberi and was pushing on to Bulamir.

Watching their expressions keenly, I tried to see pleasure or displeasure, but the brothers kept poker faces. After all, Salar was the boss. What he said went.

As Sternal and Ali Murad Khan continued to discuss the type of road being built, I turned to Cheragh Ali, who sat next to me, and asked where I could see Salar. He learned a broad smile and told me Salar was at Kumitak. Somehow from that moment he and I became close friends.

Other Bakhtiari had come into the room one by one, or stood on the big porch, all looking and listening. Many had on heavy leather bands of cartridges and carried rifles suspiciously like those of the Iranian Army.

Cheragh Ali told me we could travel by auto to Kashnigan, about seven miles east out, but could not reach Kumitak by car. After instructing us to go on to Kashnigan with Cheragh Ali as our guide, Ali Murad sent a note by horse rider to ask Salar to come to Kashnigan at his earliest convenience.

Cheragh Ali put on a band of cartridges, took a fine well-cared for rifle from a servant, and indicated he was ready. He wore a Bakhtiari coat of gray wool with thin, black vertical lines woven into it to form a skyscraper design on the back across the shoulders.

Like all the other Bakhtiari, he had on black-silk trousers fully 50 inches wide and sharp-pointed white-canvas shoes with a bit of the sole leather curved over the center of each point. On his head was the typical black hat, which is not unlike a derby without a brim.

About two miles out of Bulamir a horseman suddenly approached the car and spoke in Bakhtiari dialect to Cheragh Ali. The man was six feet tall and extremely impressive in his gray coat adorned with bandoleers of

cartridges. Taking a hurriedly scribbled note from Cheragh Ali to be delivered to Salar, he started off ahead at full gallop.

His elbows rose and fell to the rhythm of the horse's movements, so that with his canvas-shod feet sticking out on each side he seemed a fair compromise between something regal and Ichabod Crane.

Between Kashnigan and Dulamir is Iskandari, a river village near which we planned to build a bridge. I had just finished inspecting the bridge site when Cheragh Ali told me the *Rish Safid* ("white beard," or village chief) of Iskandari was coming down to see us.

Sure enough, half a score of men were walking toward us, and on Cheragh Ali's advice we went to meet them and returned to their village for the inevitable tea.

It is considered discourteous to pass through a village without having tea with its chief, whether he be a Rish Safid, a *Kad Khoda* ("village god," hence chief), or a *Khan*. The Khan ranks highest and rates like a prince or minor king. The other two seem to be equal in importance, but the title of Rish Safid is saved for older leaders.

Meeting the white-bearded Rish Safid halfway down, we continued on foot with him to his home. The news of a bridge to be built where his makeshift one now stood was clearly agreeable to him. Each flood took out his structure, he said, even though it was now supported by the gravestones of some departed Chahar Lang.

### The Home of the Rish Safid

The home of the Rish Safid was only a little larger than the other 50 or 75 of the village. Passing through a wooden doorway in a mud wall, we crossed a courtyard kept in dust and dried dung and mounted a steep stairway seemingly carved out of the mud of the walls of the building.

The rooms surrounding the courtyard were of several sizes and at many levels, the whole arrangement decidedly without definite plan. Here, too, camel grass edged all the roofs. At the top of the stairway an elderly servant, truly Bakhtiari in his wide black trousers, showed us to a room overlooking the courtyard and the beautiful valley to the south.

Since this was a poorer family, there were no chairs. We sat cross-legged on fine thick carpets, our backs eased by large bolsters of pillows covered with homespun cloth. Product of Iskandari, the bright hand carpets owed their colors to dyes from plants and fruit skins available near by.

The son of the Rish Safid sat on one side of me and the Rish Safid on the other, both talking across me constantly in their dialect.

At length the son, who knew a little English and wished to practice it, asked me to stay there that night and go hunting with him the next day. I thanked him and replied that we were on our way to see Salar, but that I would be glad to accept his invitation later on when I was there with our engineers.

When the elderly attendant began passing tea, the Rish Safid warmed up his opium pipe. The attendant's shoes had been left at the doorway, as had all of ours. I noticed several holes in his socks, just like those in mine. This business of living in a foreign country with one's wife in America has dozens of disadvantages.

All villages grow the poppies for opium and collect it, selling part to the Government and turning over the rest to the village chief for his use or sale. The Government operates a monopoly on opium and tobacco.

The juice of the seed pods is collected from cuts made in the pod. The half-dried juice is then kneaded to the consistency of molasses taffy, and flattened into cakes about three inches square and a quarter inch thick. Squares of one-half inch are marked out on the surface of the cake, which when dried a bit more is ready for sale.

Though each square is considered a full pipe charge, some smokers consume three or four squares at one sitting.

Virtually all Khans and village chiefs smoke the pipe three to six times a day. One aged 57 smoked more than the rest. Cheragh Ali Khan tried and tried to get me to smoke, but I in turn asked him to begin. He, I found, was not a smoker.

When the old man's pipe was finished, we rose and indicated we would go to Kashnigan. Thanking him and promising the son I'd return after a week or two, Steenal and the rest of us took our leave.

### The Political Grapevine

Steenal told me, as we got into the car, that he had learned from Cheragh Ali that Salar was in communication with the other half of the Bakhtiari about the work we planned and that letters had passed between them only a month before.

Beautiful farms stretched out on all sides of us. The river wound its course in and out of oxbows cut in the steep, fertile soil. Plantings of poplar trees here and there dotted the river edge. A huge eagle flew over Iskandari, circled twice, then headed down the valley as if to herald our coming. A flock of lambs crossed the road in front of us, and the hump-bend boy, his soft canvas knapsack bulging

**Dreary, Windowless Mud Walls Give No Hint of the Graceful Living Within**

[illegible] the cave.

with the whole-wheat breads, [illegible] from the whole he [illegible] some of them baked from [illegible]

We entered Kashnigan by car and drove [illegible] through the narrow lanes [illegible] Khan's house.

Cheragh Ali [illegible]

[illegible] the cool shade of [illegible] house was we [illegible] Mohammed. Ali Khan, the owner, was out hunting, as are all good Khans most of the time. His first in charge put the place and its contents at the disposal of Cheragh Ali Khan, who in turn gave it over to us.

When Cheragh Ali told the man to bring [illegible] full of strange things. Cheragh Ali and I sat [illegible] a large gaudily shaped [illegible] other [illegible] chopped-up greens. Large pancakelike breads were served [illegible]

We sat [illegible] over the tray. No spoons or forks were provided [illegible] had taught me to eat with my right hand [illegible] a piece of the limp bread [illegible]

Much to Cheragh Ali's amusement, I [illegible]

aged fairly well. He, I think, had expected me to flounder through the meal, but when he found I knew a bit about his methods, he drew himself nearer in a gesture of closer friendship.

As each of us finished, a servant brought a big silver bowl and a long-spouted silver pitcher of water to wash our hands. A bright-colored homespun towel was offered us as we washed. Other servants had removed the trays and had brought in three braziers with teapots nestled at the edge of the charcoal embers.

Soon the opium pipes of three of the party were brought in.

We were all served tea in glasses set in silver holders. Following Cheragh Ali's lead, I took three lumps of sugar, put one at a time into my mouth, and sipped the tea through the sugar. The three lumps just lasted out the full glass.

As the tea was finished, I noticed the opium pipes being warmed up. Cheragh Ali turned to me and said, "*Nash nash!*" This is a dialect expression for sleep.

I said I felt like going out for a walk. All looked drowsy, and I saw Siemal already dozing in his corner against a big bolster.

### Word of Salar's Approach

As I packed up my camera, Cheragh Ali told me that a man had just galloped up from Kommak with word that Salar would arrive before suppertime. Salar was coming to us! That was an indication of friendship, I thought. Or was it to stop us from traveling farther into his territory?

All the lesser Khans had been genuinely kind and hospitable; could Salar be so greatly different from his brothers? I put on my shoes and went out through the doorway and the dirty courtyard to the street.

A throng of children and men stood around our car. It was the happening of the year for a car to come to Kashnigan. Seeing my camera, the children begged me to take their pictures. I did take some and had a hard time explaining that I couldn't give them the prints then and there.

As I walked uphill along the lane back to Kashnigan, I saw farmers carrying long-handled shovels or using them to divert water through the irrigation ditches.

Each day a different section received water on these farms. Every seventh day the men would be back on this same piece of land they now were tending.

There was no main street in Kashnigan, but as I passed the Khan's house I turned in front of the bathhouse and wandered down a crooked, well-traveled alley to a cobbler shop, where three men were making native shoes with leather sides and amazingly serviceable soles of hard-compressed rags.

I asked how much a pair of shoes would cost for each of my children. While I was persuading the cobbler to lower the fantastic price he demanded, the village barber suddenly poked a small mirror in front of my face. He was a jolly fellow with a neatly trimmed gray beard, big brown eyes, blue-denim Bakhtiari trousers, a knee-length coat of the same material, and a Bakhtiari hat of black felt. A long, hand-knitted woolen scarf made at least two circles around his middle. In the folds of the scarf were stuck three hair clippers, a comb, a pair of scissors, and two razors.

His sales argument was the customer's impression of his face in the mirror, a practical application of Confucius' saying, "One look is worth a thousand tellings." I watched a sale being made after I politely turned the barber down.

### Women Dress Up to Do the Washing

At a widened part of the stream which ran through the village, women were washing clothes. They wore their best, for each wished to appear well in the eyes of her friends.

Washing offered a grand place to learn the latest news or gossip. Silver and brassy-looking gold bracelets clinking, the women lit the laundry on flat stones with wooden paddles. Now and then I caught a glimpse of gold earrings hanging amid folds of hair.

These women did not wear veils, as do most Iranian women in the cities. They are distant from cities and probably feel as if the village is one family. They turned bashfully when I came along and giggled no end as I watched them at their work.

I had on a windbreaker with fur lining and a zipper down the front. With great shyness the oldest and ugliest of the group overcame her embarrassment enough to point to the fur and zipper. I took off the jacket and helped her put it on, while the rest stopped their washing and all made a circle around us.

By the time my elderly Bakhtiari woman was fully zipped up, we were entertaining about fifty women and men, young and old.

All at once a horseman rounded the corner of the alley, and then many more came behind them. It was Mohammed Ali Khan, the Khan of Kashnigan, returning from a hunt. A large mountain goat lay across the saddle of one of his followers. All were heavily armed.

The poor old woman frantically struggled with the zipper, trying to get off the jacket

"You Can Build Your Road," Says Salar Iqaseem, Chief of the Chalan Lam, Tribe

[illegible] ship pulled him to [illegible] Not [illegible] the author. "We [illegible] to [illegible] the land [illegible]

and away from the scene. I pulled the tab down and helped her out of the coat. Mohammed Ali Khan, his soldiers, and the whole crowd were laughing so loudly that it sounded like a cheering squad at a football game. The woman ran at full speed toward her house. The other women had long since left.

Walking forward, I introduced myself to Mohammed Ali Khan. He was very handsome in his hunting clothes and was mounted on a beautiful dappled-gray Arabian stallion.

Finally quieting his laughter, he said he had heard we were at his house and had cut short his hunt to return to see us. He apologized that he had to go to the next village to bow and said he would come up with Salar later in the afternoon.

As they all rode past me, I shook hands with each of his men and looked for a minute at the big horns of the goat. Its beard was prized as an ornament for the clubbes of young men of the Khans, for it was said to bring good fortune. Chetaqh Ali had told me I [illegible] shoot a goat and send the [illegible] to my [illegible] in America. We had a date for that hunt later.

### Prize Sheep Killed for the American

Inside the courtyard of Ali Khan's house a sheep had just been killed, and the carcass was being hung upon a tripod of three poles. At respectful distances two typical wolflike dogs and several cats watched [illegible]

A [illegible] young farm boy in blue denim lifted the sheep into the noose an older man had tied at the top of the tripod. He chased away a dog from the bleeding head. After the hind feet were in the noose and the old man had started skinning, the boy picked up the head and put it on a tray near the scene of [illegible]

Mohammed Ali Khan [illegible] to kill a sheep for the American, [illegible]. "Are you the American?

I said "Yes," and asked if it was a good sheep. He assured me it was the best sheep in Kashmirun, and noted that tonight I would eat the finest *kebab* I had ever tasted.

He grabbed the sweetbreads, indicating they would be put on a spit and specially roasted for Salar and me. Even if I didn't like the road, kebab for that night seemed assured.

The farm boy showed me the kitchen, where women were baking pancakelike loaves of bread. A girl offered me one. It was warm and good. Still grinning, the boy accepted half of my bread while we walked out.

Cheragh Ali, who stood in the courtyard as I came out of the kitchen, took my hand and suggested a walk. It is the custom for men to walk hand in hand.

Reaching a hilltop, we stood talking about the country, the crops, hunting, and almost everything of the Bakhtiari everyday existence. My friend urged me to tell him all about America. Did we have mountain goats? Did we have dogs? Did we have horses? Did I have children? Did all Americans have a million dollars? Did all Americans have false teeth?

That last is a subject of never-ending interest. I have a bridge and must use much ingenuity to keep from having to show it at every meeting. A gold fastener gives it away.

As we talked, Cheragh Ali kept his attention on a tiny black spot on the road far down the valley near the narrow pass. I thought it [illegible] sheep coming home after a day [illegible] wandering. But Cheragh Ali said, "Salar."

### Salar Arrives amid Pomp and Circumstance

Soon the tiny dot became a group of men on horseback, perhaps twenty or thirty. Two front men rode about 500 feet apart and a half mile ahead of the main force. Even in the distance I could see that all the horses were fine looking and the riders well able to handle them. The glint of the sun on cartridge belts and rifles showed that all the men, even the leader, were heavily armed.

The lesser Khans of the village had also seen Salar's approach and had called Stemal and the others from the house. There was a considerable crowd when we arrived on the field in front of Ali Khan's house. Cheragh Ali began to dust off his clothes while a servant rubbed his shoes.

Seeing Stemal, I asked him to stay near me and to nudge me if I should say or suggest anything he knew to be against custom. He smilingly told me he'd help all he could and reminded me he also had a big stake in the outcome of this meeting.

About six of us stood together, a bit apart from the large crowd of villagers, which was increasing in size minute by minute. Salar's coming, I have no doubt, was enough to cause interest, but to have some strangers waiting to see him made it doubly important.

Also I had tried to have it generally known that we were engineers for the long-planned road and Karun dam. That meant work, and work meant money.

The two advance riders finally reached the far end of the long flat field. They rode stiffly up toward the house and so directly past us. Cheragh Ali returned their greeting as they rode by us. Stemal and I also nodded to them. I moved closer to Cheragh Ali.

Another man rode on to the plain, and then another, on a marvelous gray stallion.

"There is Salar," Cheragh Ali told me quietly, and he became stiffly distant all of a sudden.

Salar rode straight toward us. He was followed immediately by Mohammed Ali Khan. In front of us he drew rein. Four Bakhtiari jumped from the crowd and held the bridle of the horse, while the others held the stirrup, took Salar's gun, and finally led away the horse toward the house.

By this time Mohammed Ali Khan and many of Salar's soldiers had ridden up and dismounted. Servants led the horses away to stables while the dazzling group of Khans, soldiers, and peasants milled around us, all shaking hands and exchanging greetings.

No colonel ever faced a general with greater respect and obedient attitude than Cheragh Ali faced Salar. He stiffly introduced us to his chieftain brother.

Salar was shorter than Cheragh Ali, perhaps 5 feet 8 inches tall. He was about fifty years old and muscular. He had a handsome sun-burned face with large brown eyes that appeared able to penetrate everything they saw. In a slate-blue suit and with trousers tucked into tan golf socks, he stood in front of me, a seething bundle of muscle and vitality. His smile was broad (page 336).

### "You Will Be One of Us"

He extended his hand in a generous manner. Then went the rounds, greeting all in our immediate group. The handshaking he ended quickly, and, taking my arm and the arm of Cheragh Ali, he headed us away from the crowd toward the far end of the field.

Could I speak Persian? French? What a pity! He wanted to talk to me directly. Cheragh Ali put in that I could speak Persian, but I said that he would soon see that it was very little.

**Lacking Wood, the Bakhtiari Dry Briquettes of Manure for Fuel**

These patted [illegible] on a [illegible] burn briskly, evenly, and smokelessly. For quick, hot [illegible]

[illegible] "Sahib quickly turned to face [illegible] "Do you like our country?"

[illegible] "I don't [illegible] wish to leave."

"Very good. You will be one of us. You will [illegible] and a spot of [illegible] for you. I will [illegible] you a [illegible] well [illegible] valley."

Sahib became more generous with each sentence. Not letting a chance to make friends pass, I at once fumbled in my pocket, bringing out a *10-rial* note (about 30 cents).

"Here! I pay you my first taxes," I said, giving him the note.

This sally was greeted by strong laughter. "You are a [illegible] I like country such [illegible]"

At that time I could not realize how lucky I was [illegible] the conversation had turned in those channels. Later this line of talk was to help me greatly. It was just one of those [illegible] which [illegible] I have in the full power of a good clear mind. [illegible]

### Luck Is with the American

We [illegible] to feel [illegible] about [illegible] country. [illegible] As shadows lengthened [illegible] toward the village.

"You work with Dr. Wa[illegible]" he [illegible] suddenly.

I said I did.

"*Tavaan!*" Salar asked with a sparkle in his eye, pulling at an imaginary handful of chin whiskers. The word means "mountain goat" and is not at all disrespectful (page 351).

Salar said he had seen Dr. Wilson the year before when he first came to plan the road. I didn't follow this up. Perhaps Salar might talk more about it and I could get his feeling before I floundered into an error.

He changed the subject, however, and we were talking guns by the time we reached Sternal and the Khans.

Mohammed Ali Khan stepped forward and asked us into the house. There is a definite setup of ownership among these tribes. The Khan owns all the houses, the people, the farms, the supplies, everything living and inanimate in the village; and the chief owns the Khans; so, rightfully this was Salar's house, lived in by Mohammed Ali Khan.

### Precedence and Protocol

If I went to a shop in a village it was disrespectful to pay for anything I bought. It was the Khan's shop and I was a guest of the Khan. If the Khan was with me, he would tell the shopkeeper to see the *Kad Khoda*, or village chief, for his pay.

While I was a Khan's guest, he temporarily turned over all his possessions to me.

Salar led the way to the house, but at the door we all backed up and each said, "If you please."

It was a deadlock. Salar was chief. He rightfully should enter first. He was giving his place to me and also to Sternal.

I took Salar's arm and firmly pushed him with me so that we entered together. All laughed, and we proceeded to the room where we had eaten. Since it was now dark, two tall kerosene lamps stood in the center of the room, dominating it with soft light.

In filed the rest after us: Sternal, his engineer, Mohammed Ali Khan, Cheragh Ali Khan, Askandri Khan, three or four other Khans, many bodyguards each loaded down with cartridges and a very businesslike-looking gun, and finally some servants.

No women, of course, were in sight. They are never seen by a vis-a-vis except around the village streets. Outside I could see the scurrying of the help back and forth in the courtyard. We all took places around the edge of the room, and with another "If you please" from Salar we all sat on the floor. Our shoes we had left at the door.

I drew a lovely yellow and red carpet to sit on and unconsciously rubbed my hand over its pile. Mohammed Ali Khan smiled at me in appreciation of my interest.

Salar had arranged the seating. He sat at the end of the room near a mantle-like shelf of small lamps and photos, his back propped against a bolster. Sternal came next.

I was supposed to sit there, but quickly crossed to a place on the yellow and red carpet opposite Salar so that I could watch his face. I pleaded that Cheragh Ali was my interpreter.

Cheragh Ali was on my left. Mohammed Ali Khan sat next to Sternal, opposite Cheragh Ali and myself. I could see Sternal and Salar well, since the lights were between us and to my left. It was nearly 7 o'clock.

Like the rest of us, the soldiers sat cross-legged. They had on their bandoleers of cartridges, and their guns lay across their knees. They kept on their hats and shoes. The Khans, too, had kept on their hats, although they shed the cartridge belts and guns to servants.

Five braziers of burning charcoal embers were brought in, and each Khan was handed his own opium pipe. The Khans began to slide together in easier access to the nearest brazier. Pipes unwrapped, they were held against the coals to warm the china bowls.

### Head of a Mountain Goat

Salar had been talking about needing one more rain for the best opening of the wheat and barley then heading out in this valley of Kashnigan. Mohammed Ali began to tell how he had shot the mountain goat. The other Khans jokingly told him he never even saw a mountain goat, and teased him until he ordered a servant to bring in the head.

In a short time the trophy appeared on a silver tray. They all admired the bloody beard and then told me I must shoot one with them.

So the talk went. Sternal was asked about prices in Teheran. I was cross-examined about America. My shoes were picked up and handed around. More questions followed and the puffing of opium smoke.

Mohammed Ali Khan started to prepare his pipe. When the pearl-handed pin used for poking the hole in the china bowl dropped out, he first began a thorough job of picking his teeth with it.

One Khan asked me what time it then was in America. That started a half hour of talk, which became more and more confused.

Impatiently I waited Salar's time to talk out business. I was in no mind to rush things, for Sternal had advised against that procedure. I fidgeted on my numbing legs.

Tea was brought for all in the same silver-holdered glasses we had used at lunch. Opium smokers drink endless glasses of highly sweetened tea. Slowly it drew toward 9 p.m.

I [illegible] pretty hungry. I suspect Salar had the same feeling, for he caught my eye and, holding his hand to his stomach, asked, "Eat, eat?"

I nodded and rubbed my stomach also.

He immediately said something in dialect to Mohammed Ali Khan, who repeated the message to a servant. Evidently the pipe smokers heard the order, for they all puffed loudly trying to rush the departure of the pill they were then smoking. Soon servants came in to take away the braziers, pipes, and tea glasses.

After a short time a tall servant appeared at the door of the room with a large white cloth folded under his arm.

All the guests slid back against the walls, and the servant spread the tablecloth on the floor. After smoothing it and making its corners come to Salar's and my feet, he stood in the center barefooted.

"Come," he called in a deep voice.

Other servants entered with the three-foot trays, filled with bowls, glasses, bread, bottles, and many other things. First the big fellow took the bread from one man. He carefully put one large round loaf at the edge of the cloth for each Khan and for us. At the far end of the cloth he put them down like shingles overlapping each other to accommodate all the soldiers.

### The Prize Kebab Good as Promised

Still standing in the center of the cloth, he began to place the dishes in a somewhat symmetrical pattern.

A large dish of rice heaped high came first. This was sprinkled with rice which had been boiled in yellow saffron.

Another dish of rice and lentils followed; then a bowl of pot roasted lamb in a sauce containing cherries (I found out they were cherries later by biting into the pits); an omelet on a silver plate; a puddinglike cake of spinach; a small plate with four little hearts of wild celery from the mountains; a deep dish of thistle sprouts, dug also from between the rocks of the slopes near by and cooked in thickened buttermilk; bowls of *mast* (clabber); large bottles of plain buttermilk and some buttermilk with chopped greens in it, a dish of rice fried to a crisp in butter; roasted chicken; and the prize—a flat dish an inch deep in rice on which reposed upside down a roasted lamb's head, skull and all.

Only we near Salar had the celery and the lamb head. Silver plates were put on top of the bread.

Salar took a broad, flat spoon and heaped my plate with rice. Soft pieces of lamb fell out of the pile as he dished it up. He then took some for himself and motioned me to the other things.

The big servant leaned over Salar's shoulder to put a folded pancake of bread between us. I saw pieces of roasted meat in the folds of the bread. Looking out of the door over the heads of the eaters, I could see the grinning farm boy. He had accomplished his promise. It was the special kebab.

There were no forks or spoons. All dived in, taking the food in their hands. Compressing it with their fingers, they passed it into their mouths with bent thumb. I managed as best I could, using the lamp, warm bread as a folded spoon.

### Breaking the Lamb's Head

Cheragh Ali told me to take the lamb's head. I passed it to him; for breaking it open was a trick I had often seen accomplished but had never tried myself. He tore off two pieces of bread, put these on each end of the head, and pushed downward. The head broke in half. He held the neck end and offered the broken end toward Salar.

Salar, using his index finger, dug out half of the warm, soft brains. I next did likewise for the other half.

Cheragh Ali knew other good parts which he took for himself. Mohammed Ali Khan took the tongue. The rest disappeared down the cloth.

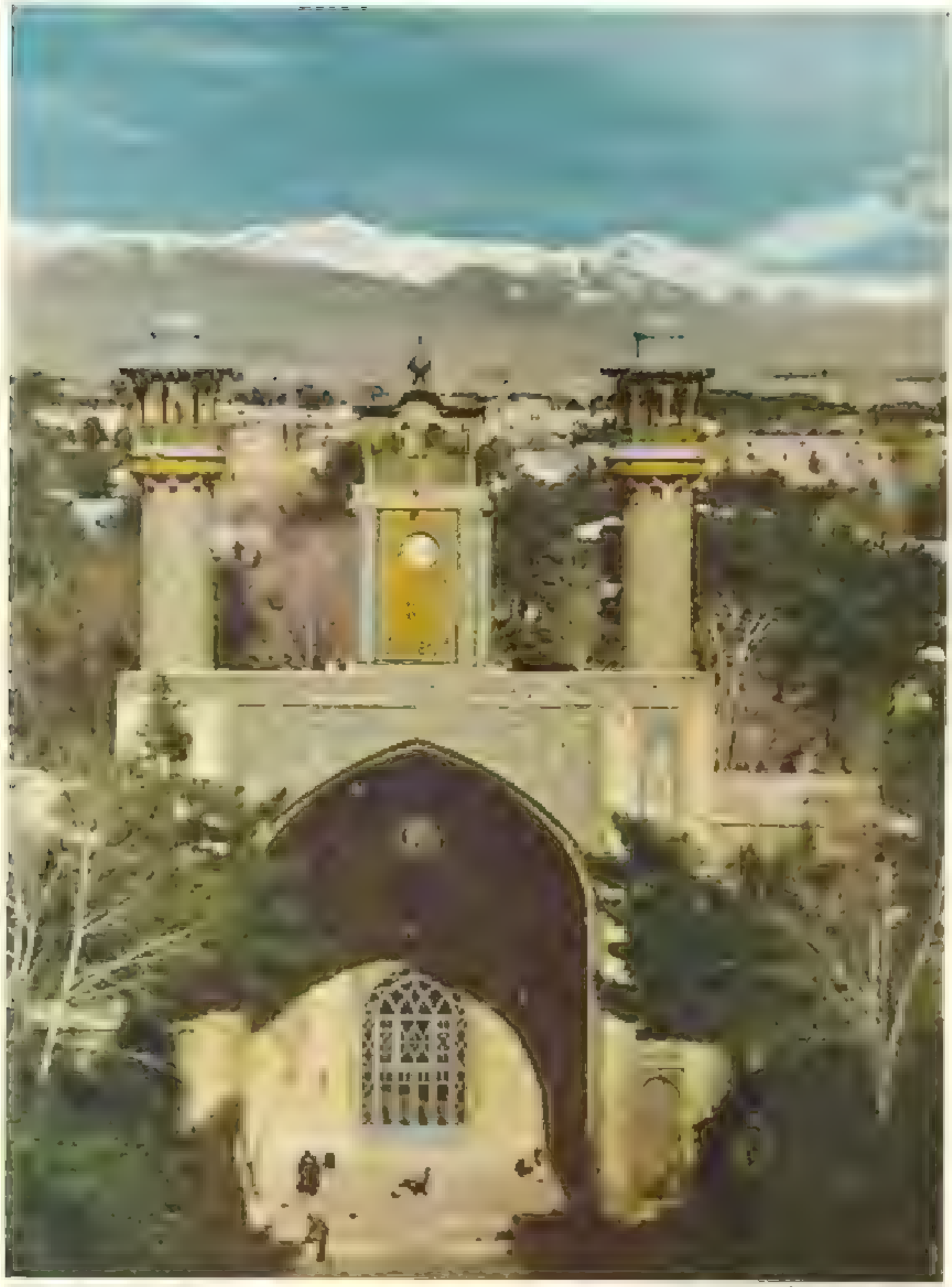
Salar put one piece of the celery on my plate, Nizzal's, Cheragh Ali's, and his own. We all ate and drank quietly in silence except for the sound effects of the eating operations.

As they finished one by one, the Khans got up with no excuse and walked toward the other end of the large room to take turns washing their hands.

Salar and I stayed till last. A servant brought us the bowl, pitcher, and towel. The food was then taken away. The cloth containing the overflow of fallen rice, bones, bread, and so on was folded up and taken away. Braziers and tea were again brought in, as were the opium pipes. All settled back against the bolsters for tea.

"You have eaten with us; now what do you think of us?" Salar questioned me.

All turned toward me. It was said in a different tone and in bookish language. I looked inquiringly at Nizzal. Because I wanted to have the proper meaning, he translated for me.



Gazing Down Below Snowy Elburz Spreads the Colorful Capital of Iran

**In a Sheltered Nook Warmed by the Sun, an Old Muslim Thumbs His Well-worn Koran**

[illegible] Tabern Stop Windows He Studies Facades of Historic Buildings

[illegible]

Museum Bureau Looking Toward [illegible] Schools. Lines Up at the Meridian and Central Square

[illegible]

Aiyz. Mahi Pahlevi, Deposed Leader of Modern Iran, Gazes at the Splendid University He Created

[illegible]

Although the Veil Was Abolished in 1930, These Females in the Intzan El Abadar Clinic to Lose Cancerous Breasts

© National Geographic Society

Kodachrome by Volney Wilson, Washington

**Old Gates, Worn Flagstones, Cobbly Annabad Headquarters of the Persian Girls' Command**

[illegible]

**Fresh Roast Potatoes Combat Iran's High Cost of Living**

[illegible]

**Soft Carpets and Hot Tea Add Comfort to Iran's Traditional Hospitality**

[illegible]

New Grain Sprouts, Sprinkled on a Plate, Welcome the New Year in Teheran

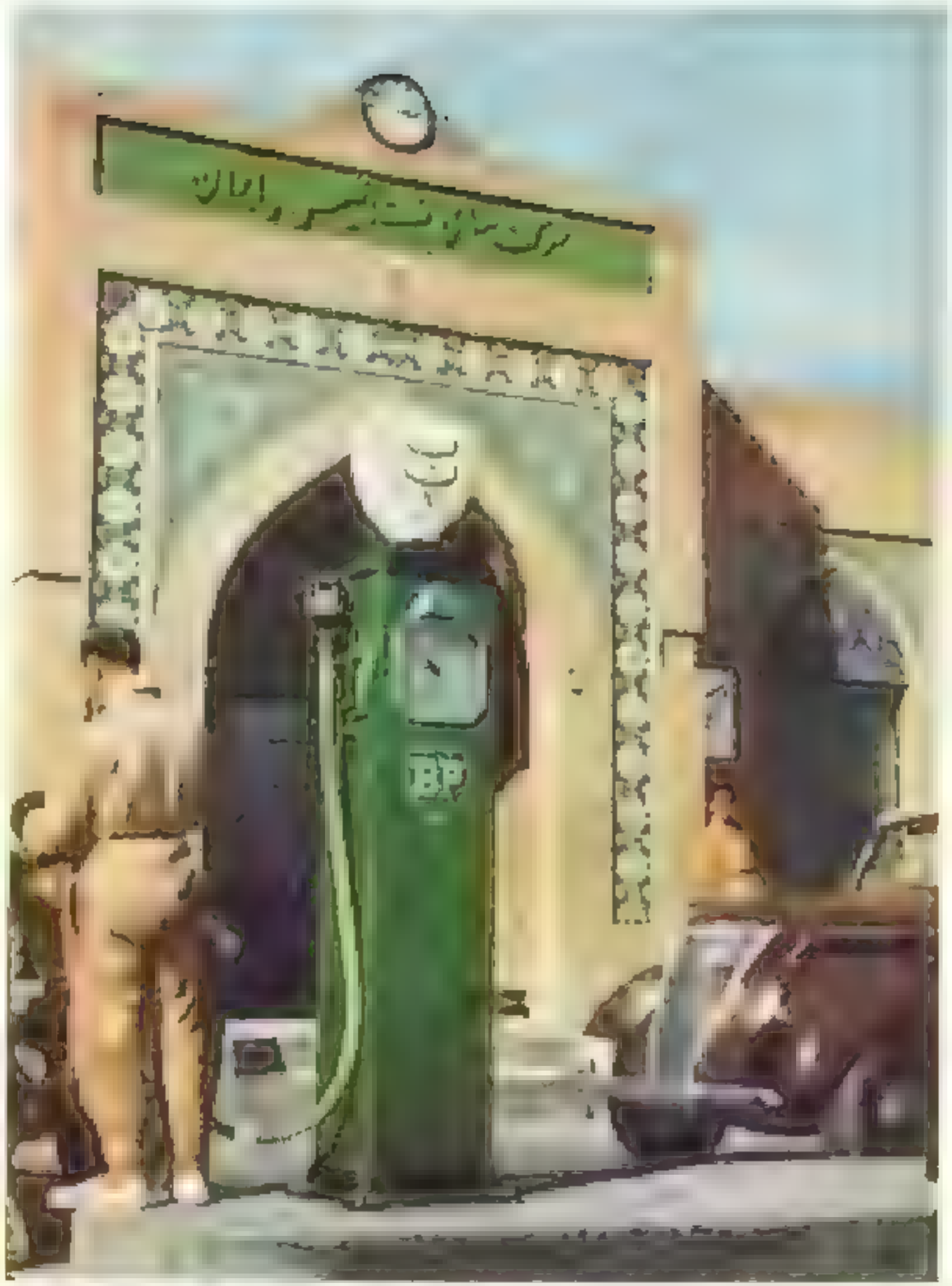
[illegible]

Nature Boats Float in Iran, but Scarcely Keeps on the Sea of Iran

[illegible]

In Palmleaf Baskets, Dried Dates Arrive at a Packing Plant near Basra

Iran Lance in Front of Bank and Post Office Serves as Display Rack for Old Mags on Sale in Tehran




In Arabic Script or Latin Letters "BP" Means Gas Line

Persian Rugs Add Art to Mashin's Shop Fronts

Number 258 Natives Dead in Front of Moslem Mosque at Cape Haitien

Sisters Ride on a Mechanized Rickshaw in Dezful, "City of the Wind"

Nasir Ahmad's Big Retorts, Nuts and Raisins Gather Dust in the Bazaar

Graceful *Belums* Shaped Like Ancient River Craft Serve as Ferries in Basra, City of Sindbad the Sailor

An Arab Wears Goat's-hair Crown and Robe with Easy Grace

His Smoking Istakani Agency Does His Old Skullcap

Palm-crowned Palace of Dates Protects a Young Arab Girl and Her Elder Brothers

[illegible]

Fake Laborers Hurling Building Stone Hence Forces Large Business of Dates

[illegible]

"I have paid my taxes to you; I am of Chahar Lang," I replied. "This wonderful meal has made me only more happy that you have accepted me. When I go to Isfahan, I shall buy cloth for trousers and a coat. I shall wear your clothes."

I said this in English so that Stenal would tell Salar my exact words. I couldn't do that in Persian. All laughed, as did Salar. He nodded his head in approval. He turned to Mohammed Ali Khan and talked in dialect. Many Khans entered into the discussion. Salar faced me again.

"We have a suit for you. It is coming."

All this time Salar had been unwrapping his pipe. As he took it out, I saw it was a different one, with a beautiful blue bowl and a gold band where the china bowl and wood stem joined. He fumbled in his pocket for his knife. Since he couldn't find it, I offered him the new Army knife my wife had just sent me.

He scraped the bowl and then began to inspect my knife. It was the last I saw of it as my own. He fastened it on his key ring and proudly displayed it to all the Khans.

### The American Becomes a Bakhtiari

About that time the tall servant appeared with my costume. Laughing, Cheragh Ali moved the oil lamps and demanded I put it on in the center of the room. Salar entered into the spirit of the act and urged me up. There was no getting out of the situation.

Cheragh Ali and Askandri Khan took it on themselves to dress me—or rather undress me. They indicated they wanted me stripped down to underwear.

Each piece as I took it off was passed around for the inspection of everyone. They even went through my pockets. My blue light wool shirt pleased them all. The belt got a minute going over.

First they put on me a pair of heavy blue silk trousers. There was a waistband covering the pleats at the top. Because I was now much thinner than when I left America, the waist just fitted me. The trousers were voluminous.

Next they put on me a silk shirt, then a coat, then the heavy gray-wool topcoat with 6-inch sleeves.

A black hat was brought, but it did not fit. Cheragh Ali took off his and put it on my head. All cheered. They had forgotten the canvas shoes, but I didn't remind them. Cheragh Ali shook my hand, as did Askandri Khan and all the rest in turn.

Moving closer to Stenal, Salar indicated I should sit next to him in the space he had made. "You are Khan now," he said as I sat down [page 311].

"American Khan is my name. You have now Khans of two countries."

Salar went back to the pipe. We all sat in silence for a short time.

### The Direct Approach

"What have you come here for?" was the thunderbolt Salar used to break the silence.

"To ask your cooperation in building the road to Tang-i-Gaz and the Karun dam," I replied through Stenal.

"What will you do if I say we don't want the road and that I will stop you?"

I broke out in a cold sweat. This directness had taken me by surprise. It was not the custom. Usually there were a lot of compliments and round-the-bush talking, and finally each gathered the other's idea. This wasn't in the books.

"You will say such things only when they hurt Chahar Lang," I replied. "This work will not hurt Chahar Lang and will help the people—your people and Isfahan people. If it would hurt Chahar Lang, I would not work for it myself. Even though we laugh, I am proud to be of Chahar Lang. I would not work against my own people."

All the Khans and soldiers leaned forward in interest. Outside, the doorway was jammed with lesser men and servants.

"Can you say that the Arms will not use this road to repeat the terror they spread through our village only a few years ago?" Salar demanded.

"Do you know that nine years ago they took that boy [he pointed to Cheragh Ali] when he was only 16 years old and led him barefoot ten miles through deep snow to Dizful and imprisoned him? Do you know they hunted us all down like dogs, taking money for our release only to laugh at us when tens of thousands of *tomans* were given? Do you know they took our crops and our animals without pay, leaving my people to starve?

"Have you heard that I spent seven miserable years in their jails and more years running in exile like a desert dog?

"No, you can't know this. You don't have such things in America, but we have had them here."

Salar had laid down his pipe. He had drawn himself up straight in an air of defiance. His eyes blazed. He was indeed very commanding in this fiery mood.

"That king has gone," I said quietly, still looking at the embers in the brazier. "That government has gone. I have not been sent

Hostess Waves Spoon the Wives of the Bedouin Princes

[illegible]

[illegible] Fatma here. Dr. [illegible] discuss the [illegible] Khan [illegible] Mr. [illegible] was [illegible] the [illegible] in the [illegible]

### "You Can Build Your Road"

[illegible]

[illegible] I have [illegible] if we ever have a [illegible] help us and be friendly [illegible] Dr. [illegible] Mr. [illegible]

We will [illegible] help our neighbors [illegible] We will [illegible] they need water. We will [illegible] us. We will [illegible] our labors [illegible] "They have come from [illegible] our mouths."

[illegible] Mr. [illegible]

[illegible]

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### INDEX FOR JULY-DECEMBER, 1937, VOLUME 72 READY

Index for Volume 72, [illegible] number [illegible] of the National Geographic Magazine will be mailed to [illegible] who find these issues an [illegible] of reference.

# Shad in the Shadow of Skyscrapers

By Dudley B. Martin

*With Illustrations from Photographs by Staff Photographer Luis Marden*

AT THE very threshold of America's biggest city there flourishes a commercial fishery that does an annual business of a quarter of a million dollars. This "big business" is done entirely in the few weeks each spring when the shad find the Hudson River tempting and swarm in from the ocean for spawning.

Here is one of those old aspects of New York which help make the ever-changing city tremble to its more rustic residents and fascinating to those who enjoy exploring its byways.

For the most part, however, New Yorkers pay little heed to this remnant of a day when the city fed itself from its own lands and waters. If they do cast a second glance, they are likely to be as mystified as was the young lady who, homeward bound to New Jersey over the George Washington Bridge one afternoon in wartime, asked a friend if those poles sticking out of the water down there didn't have something to do with stopping enemy submarines!

No wonder she was mystified. Little ballyhoo attends this enterprise carried on in the shadow of the world's tallest buildings.

The shad men would just as soon stay in the shadow, for, hard and honest though their toil is, some of them seem to feel that the netting of fish in the world's most important harbor survives only by virtue of oblivion.

### Shad Harvested for Some 300 Years

But the Hudson River shad fisherman is about as much a peasant among us as the American Indian. For some 300 years white men have worked these watery furrows for such harvests.

One early account states that "the river teemed with the finest fish, among which was the shad and many kinds scarcely less delicious . . . there were plenty of sturgeon, which the Christians do not make use of, but the Indians eat them greedily . . . herring were in [illegible]."

Another surviving account of the Hudson in early days concerns the voyage of Richard Wells, an Englishman who traveled up the lower Hudson in 1709. The journal entry remarks the unrestricted fishing, stating: "Mr Wells bought Ten small Rock Fish for 12 coppers . . . at Beekman Manor . . . 2 shad cost 6d. . . . these Fishermen draw their nets oftener than ours, not stepping between the Draughts."

If the colonial shad men kept up anything like the pace of their present-day successors, they were busy, to say the least.

### Water Front Bustles with Preparations

In the middle of March, about the time the Carolinas are getting in most of their shad harvest (some families still salting away the fish in barrels, as in olden days), the Hudson's fishermen start preparing for their turn, their interruption of the life cycle of this river-ascending fish.

By then the Atlantic coast shad season is about half finished in point of time, for north Florida folk begin sifting the St. Johns River for the greenbacks in December. In volume, however, the season is just getting going, for Chesapeake Bay, its tributaries—among which is the Potomac—and the Hudson come in quickly, one after the other, as winter gives way to spring.

Nowhere else in their appearances in thirty-odd rivers of the North Temperate Zone—as far up as the St. John, in New Brunswick, and even the St. Lawrence—do the shad, or rather man's efforts to capture them, afford as striking a contrast with the environment as in the Hudson. (Some persons, especially mariners, call the lower Hudson the North River, a relic of Dutch days when the Delaware, at the other end of New Netherland, was the South River.)

Along the New Jersey water front, amid some of the busiest commerce and largest industries of the metropolitan area and directly across the river from the teeming West Side Highway, the shad men dig from the low-tide slime of the river bed, the 60-foot hickory poles which they interred for preservation ten months before.

On the beach under the bluffs whose twenty miles of trap rock are famous as the Palisades, they see to the gill nets, the iron anchoring rings, and other gear, or calk the boats and build the shacks which are to be bases for operations in the short weeks ahead.

The sturdy poles, shaved, pointed, and replenished (for there's a heavy loss to the elements and river traffic), are now set out in the river in rows as straight as possible, the better to snare the shad as they head upriver past the Empire State, Chrysler, and other spires.

Lyrical Interlude as a Dream, Manhattan's Towers Look Down on Fishermen

[illegible] the dark river as they draw the nets supported by 66-foot [illegible] One startled shad fisherman saw horns and hoofs, thought he [illegible]

[illegible] is right a lighted lantern. [illegible] be large enough to be seen [illegible] crews of ships plying the [illegible] bank with oil and other [illegible] for Albany and lesser Hudson ports. [illegible] about a mile wide here, their [illegible] out carefully. The Army [illegible]

[illegible] is a matter [illegible] and keeping a close eye on the [illegible] A short length of fine linen [illegible] of the 1,200 feet that many [illegible] measure, is strung out in the river [illegible] trial net.

Meanwhile, the talk is of the weather, [illegible] of the church calendar.

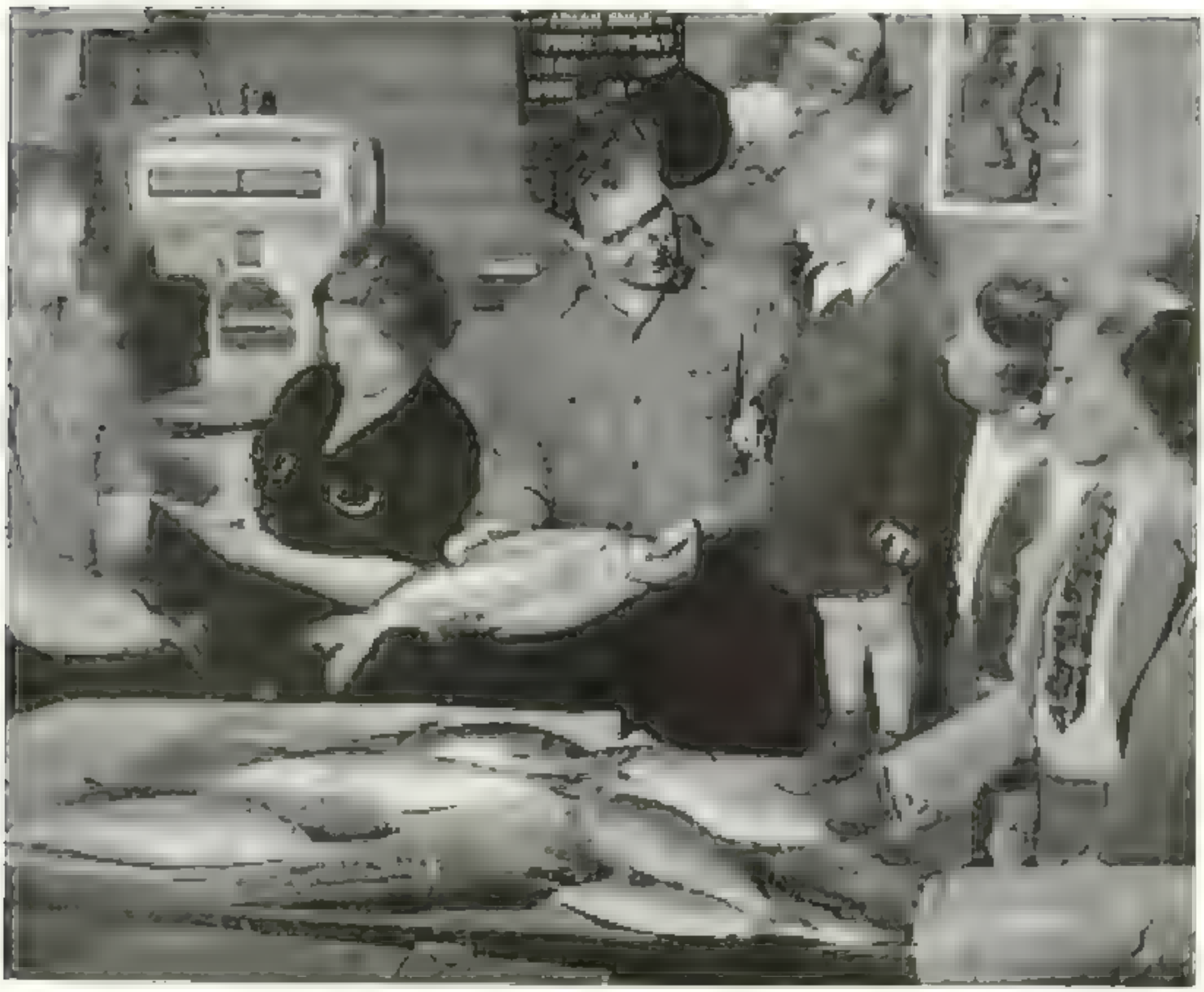
[illegible] are not particularly concerned with ecclesiastical matters, but they do [illegible] in how early or how late Easter comes. The more shad they can catch before Lent is over, the richer they will be. The later Easter comes, the better. In fact, a fish caught before then is worth in market terms, three times as much as one caught afterward.

### Hudson Shad Run Starts About April 1

The Lord, upper in this race, least [illegible] moon, is the weather. If winter was [illegible] and departed on time, and if spring is warm and dry, the shad can be expected in the Hudson about the last week of March.

While the greenbacks are in salt water they live singly or in small groups; but when the time comes for them to seek quiet fresh water [illegible] Thus it is that some time around April 1 the cry goes up along the Jersey water front, "The shad are running!"

And it's no April fool. Just watch. Out



"A Couple of Hours Ago Seems, She Was Swimming in the River"

[illegible] "blocks" are [illegible] 150,000. The larger [illegible]

[illegible] and along the [illegible] from Weehawken, New Jersey, to the New York State line the rows suddenly become a pattern of fishing men, nets, rowboats, and an occasional motor launch, the mother boat. Under [illegible] to eight weeks of fishing, [illegible] over to the totes and the catch [illegible] bear, no matter what the hour [illegible] or night.

On the "slack of the flood," when the tide starts receding from high water, the nets are lifted. And there's no guesswork about it. The bottom of the river is a half hour ahead of the surface. From long experience the shad man knows just the moment when he must [illegible] the quarry, and he and his helper [illegible] the stakes with time [illegible].

[illegible] three or four men, one or two of them rowers, is lowered to the [illegible] side. There two men in the [illegible] the net—[illegible] form a sag and scoop out the squirming fish into the boat.

[illegible] American member of the herring family [illegible] in the sun. [illegible] and the [illegible] shad-like [illegible].

Only about half the [illegible] have actually been gilled, [illegible] of the mesh, with a [illegible] hold is stillborn. All the while, the oarsmen keep the boat in position, and anyone who knows the Hudson's tides, rising [illegible] about five feet, will appreciate that [illegible].

The elements often play [illegible] men. An onshore wind, for example, [illegible] hard enough to make one rue the day [illegible] his first [illegible] experience [illegible] and [illegible] or [illegible]

* See [illegible] by John [illegible] [illegible] Scribner's [illegible] 1949.

This Big One Will Look Best Better on a Planer

[illegible]

[illegible] taken ashore [illegible] from pole to pole [illegible] the fish things [illegible] face of [illegible]

[illegible] within the bounds of the 5½-inch stretch [illegible] the mesh, for all kinds of things [illegible] in the nets. In fact these adjuncts [illegible] many an evening's storytelling between seasons for such river veterans as "Captain" Fred Truax, John Adams, Harry Lyons, Floyd Clayton, and William [illegible]

[illegible] less and less the [illegible] thanks to the increasing [illegible] use of waste for by-products and [illegible] municipal incinerators [illegible] the last few years, it [illegible] of wing and hoof.

### Horns and Hoofs in the Hudson

One day the hardy waterway was even believed to be possessed of the Devil himself [illegible] the wind or tide, either, although [illegible] "strong water" of another kind did speed [illegible]

But let Harry Lyons [illegible] two years [illegible] Washington Bridge [illegible]

"It was a nor'easter, rainin' and [illegible] and gettin' dark on the river. We're [illegible] small space. I'm on the oars. Paul Hanson [illegible] at the net. He's a Nova Scotia Irishman [illegible] very superstitious, y'know. Suddenly, Dun- [illegible]

**"Gettin' More Roses than Bucks Today"**

[illegible]

Over the Top Two Indians and This Could Be a Rustic Scene Far from Skyscrapers

[illegible]

On the "Slack of the Flood" the Lift Is Made

[illegible]

[illegible]

[illegible]

Scales in Scales—Weighing Freshwater Seal

[illegible]

Planked Shad Feast From the River

[illegible]

oak planks and set around the fire on g[illegible] wid (pages 173 and [illegible]

Now, while cooks and waiters hustled about, while the roe of the shad simmered separately in a huge frying pan inside, while the arriving police chiefs bellowed hellines, the woodsmoke of the shad bake curled up the chimney and the fragrance was sniffed enviously by several youngsters and a cat perched on a [illegible] above.

The melting bacon [illegible] started basting the fish, and care was taken to spread each plank every few minutes to give the fillet an even cooking.

When the shad had almost an hour of this hot fire and wind had come that the diners were finishing their clam chowder, the planks were taken up one by one, and put on [illegible] table at the entrance to the dining room. Here several [illegible] hands apportioned the browned [illegible] the roe and [illegible] little strips from the kitchen, and waiters hurried warm the fish and the plates before whisking the result off to waiting patrons.

He Can Regale a Gill Net with His Jokes Also

[illegible]

**Itinerant Fishermen Follow the Fishing**

Too bad, we thought, that the remarkable Andrew, the big Swede who is Mr. Kotzebue's fisherman, wasn't there to see these embellishments. But Andrew—Andrew Anderson of Bergen Beach, Brooklyn—probably was happier having a cat nap or a snack in the shack on the beach three miles up the river. And the crew's cook, a Norwegian, didn't have to make anything funny.

These hired fishermen, most of them Scandinavian and some Portuguese, have a boisterous and haphazard life. Typical, perhaps, of their outlook is the tale the husky Andrew was hauled off to a hospital with pneumonia and a dangerously high fever after he had keeled over on the beach.

Later the same day he [illegible] chill, protesting: "Al[illegible] make anybody [illegible]

A thousand or more itinerant fishermen like Andrew follow the fishing as it progresses up the coast from Key West to Kennebec. They [illegible] off Atlantic City, scalloping out of New Bedford, trawl fishing off Hampton, Virginia, bifishing in the Gulf Stream south of Ambrose, and pound fishing off the Jersey coast.

They [illegible] and sons of their suc-

Food Disappears Like Snow in Spring as Hungry Fishermen "Fall To"

[illegible]

[illegible] employment [illegible] from the [illegible] among the [illegible] fishermen [illegible] on the Hudson [illegible] with [illegible] captains [illegible]. Before the war the [illegible].

A few [illegible] uphill from the "Colonial" Tavern [illegible] the [illegible] of the Hudson [illegible] Fred [illegible]. He has been [illegible] [illegible] Herald [illegible] 1776 [illegible] Joseph Smith and William [illegible].

In his youth Captain [illegible] of the Statue of Liberty, which [illegible] on Bedloe's Island in 1886 [illegible]. His father [illegible] began shad fishing [illegible] about 100 years ago.

Captain Truax, who [illegible] [illegible] When [illegible] Hudson-Fulton Celebration in 1909 [illegible] the river [illegible] money-losing season.

That was before [illegible] of the fisheries [illegible] by the Albany and [illegible] the Federal Government [illegible] A. N. [illegible], New York State [illegible] the Hudson can be [illegible].

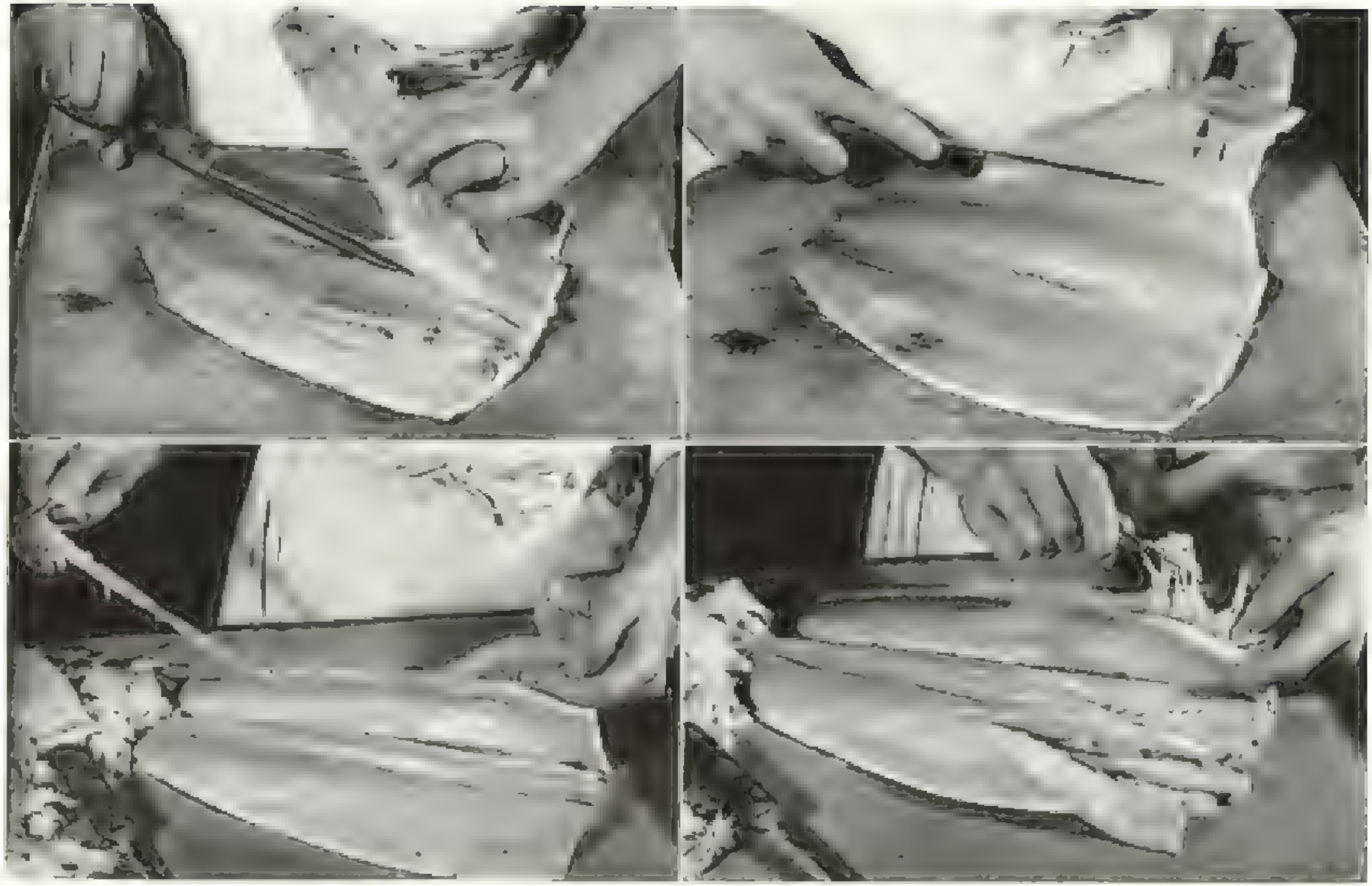
Now Captain Truax and many other old timers [illegible] through the week [illegible]

Ice Is Towering Over George Washington Bridge. Beavers Bustle with Pleasure Driving Their Nets

[illegible]

Through the Misty Air Hurtles a Shad as a Fisherman Collects a Tentacle Dividend

[illegible]



**Masters Knife and Tweezers Aid in Running Skull, the Job of a Specialist**

[illegible]

Flapping "Greenbacks" in the Boat Mean Folding Greenbacks in the Pocket

[illegible]

Delight of the Fracture is Plotted North River Seed

[illegible]

"Upper, Downie, Upper, Downie"

[illegible]

**Planked Shad Crossed with Bacon Strips Are Arrayed Before a Charcoal Fire**

[illegible]

[illegible] years on the Hudson shad [illegible]

[illegible] more than [illegible] Add to that the [illegible] New York Harbor [illegible]

[illegible] New York [illegible] Rivers [illegible] Kill [illegible]

[illegible] for shad [illegible] up to [illegible] the smaller catches [illegible] shad get near their hatching grounds. Moreover, the early market has [illegible] the time the fish [illegible] 75 miles upriver.

Consequently, [illegible] shore [illegible] Hudson during the war [illegible] proved with [illegible] to Fred Anderson [illegible] New York [illegible] and Wilson [illegible] This volume coincides with the [illegible] substitute and with the [illegible]

[illegible] the shad fishermen [illegible] the war when the [illegible] [illegible] or [illegible]

This [illegible] hundreds of [illegible] [illegible]

Chorus of the Hudson Comics Bunker after Bisher of Snuckleoo Stand

[illegible]

**Many Nets in the Hudson Measure 1,200 Feet in Length**

[illegible] smoothing and by the careless [illegible] many things besides [illegible] the shad run, the northern wor[illegible]

put the shad back on the table in its own right, rather than simply as the producer of [illegible], or roe, which had long been eaten as a delicacy (page 371).

Not always were the roe thus esteemed, however, for sometimes in the ups and downs of this fish, *Alosa sapidissima*, the roe were thrown away and only the flesh eaten. This [illegible] the Hudson's shad were famous as North River shad [illegible] Delaware coast streams. Nowadays, considerable [illegible]

**Fulton Market Prices in "Shillings"**

The marketing of shad is a story in itself. [illegible] shad from [illegible] tunnel to Manhattan, and those from distant rivers [illegible] dash day and night to the rich New York-Philadelphia [illegible] country's shad is consumed.

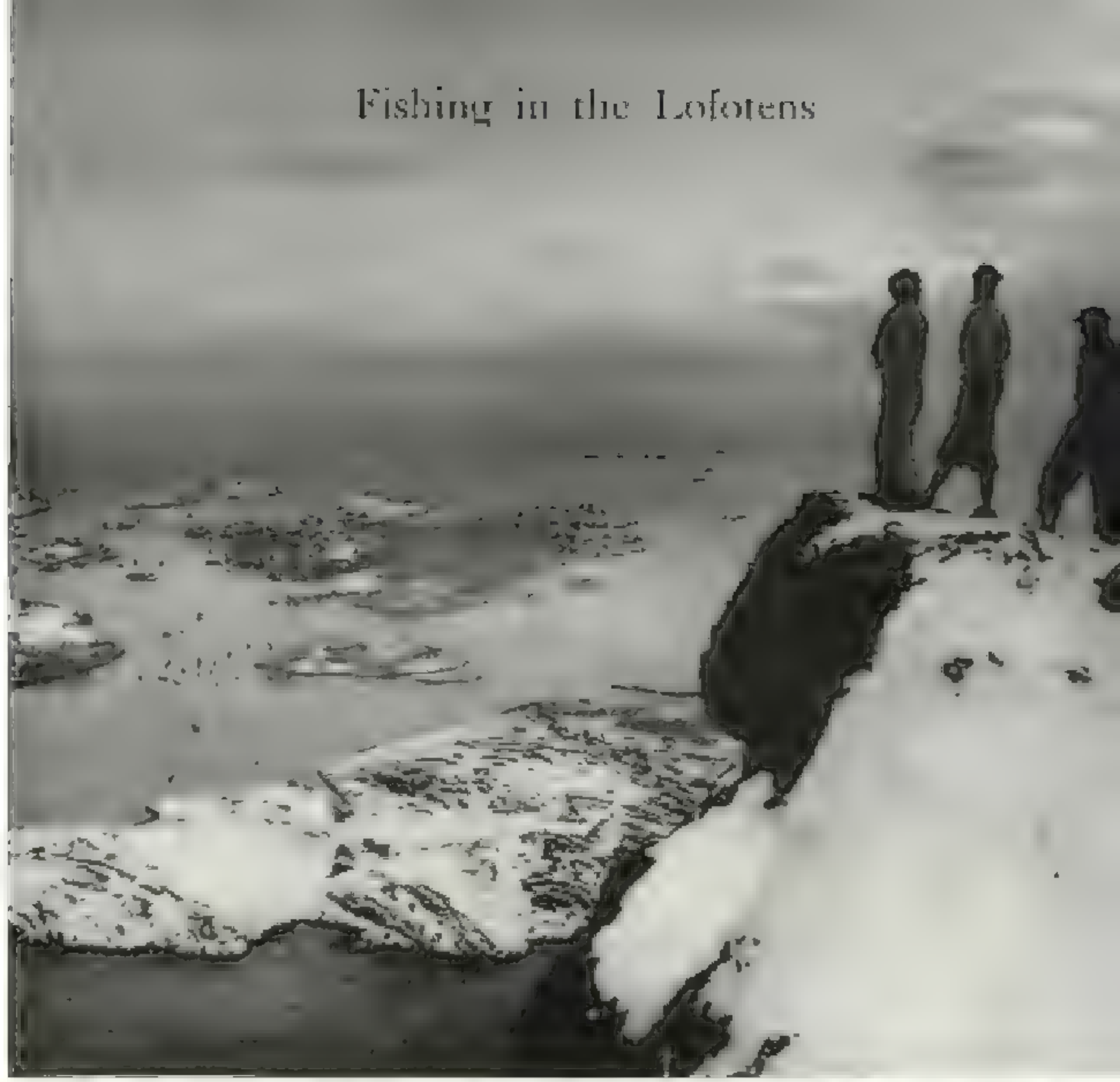
There are two or three [illegible] fishermen of the Hudson who still prefer the old way of [illegible] their catches to market. They sail [illegible] to the foot of Fulton Street and [illegible] their shad at the market instead [illegible] 100-pound boxes of the fish from trucks.

Numerically, the bucks and the roes are [illegible] weight the roes approximate two-thirds of [illegible]

Even more curious than the taking [illegible] by [illegible] the New York [illegible] Fulton Street dealers' continued use of the "shilling" (12½ cents) as a convenience in quoting prices.

But it's no wonder. With the one important [illegible] market [illegible] the whole [illegible] along the Hudson is a pleasant [illegible] excursion lines, and other features, it [illegible] retain, perhaps, more suggestion of the old [illegible] than any [illegible] to be [illegible].

# Fishing in the Lofotens



Seen from Half Mile Up, 2,000 Fishing Boats Black Out a Tiny Lofoten Harbor Center

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Like an Admiral's Staff, LaBrea Strippers Plan Campaigns Against the Cod

Stories and Nearly Empty Pots Prove the Fishermen's Liking for Cod-liver Soup


"How Much for This Zippered Jacket?" Asks a Rosebud Peddler

STEARNS [illegible]

Freshwater Coal Are Crushed and Ice-pressed for Shipment to Northern Europe's Cities

Fresh-catch Fishermen Dunk Cod Twice Before Hanging Them Up to Dry

[illegible]

Stacked Like Cordwood, Coal Are Sorted Down to Make Norway's Famous Aquavit

[illegible]

*Alaska Tourist*, Writes a Freshman Fisherman

Echo-sending Depth Recorders Tell Where Fish Are

Hungry For His Predawn Coffee, Olav Harries the Fire Alarm

One Man's Business Is Another's In Lebanon Cable Stations

Kenai's Snow-Capped Peaks, Toward Fisherman Move Mountains at Dish Horn

IN THIS [illegible]

At Sugarcane Old Houses And the Youngsters Were from Home on Their Last Passing Date

[illegible]

Though the Lofoten Season Is Short and Rushed, the Sabbath Is a Day of Rest

# In Manchuria Now

By W. Robert Moore

*With Illustrations from Photographs by the Author*

"WE'VE a buggy ride for you," said an American colonel at Executive Headquarters in Peiping. "There's a special flight going up to Manchuria tomorrow. Can you be at the airport by 6 o'clock in the morning?"

I could—and was there early.

Long after V-J Day, Manchuria was still on tarmac. It had felt the shock of not only one war, but two.

In the final days before Japan had sued for peace, the Soviet Union had unleashed a swift attack against Japanese forces stationed here. Then, following the long-delayed Soviet withdrawal, both Nationalist and Communist-led Chinese armies had moved in and were challenging each other's right to rule these rich northern provinces (page 491).

Among the American officers with whom I was to fly north, some were assigned to the task of assisting in evacuating Japanese civilians back to their defeated homeland. Others were members of a "truce team" to help supervise the fulfillment of cease-fire orders that had been issued to the rival Chinese forces.

### An Earlier "Mukden Incident"

War is not new to Manchuria. I had been in this land beyond the Great Wall just before one other war. Only days before the "Mukden Incident" started, I had ridden over the rails that the Chinese were accused of blowing up on the evening of September 18, 1931, to give Japan her excuse for the conquest of Manchuria and establishment of the puppet State of Manchukuo.

Often in the past, warring armies have worked this "circuit of conflict." From here rose wild Tatar tribes who set up Asian empires centuries before the American continents were even known. From its ramparts, too, rose [illegible] Mongol [illegible] to shake Asia but made Europe quake.

Right at our take-off at the Peiping airport we had a quick glimpse of still another chapter of bygone Manchurian history.

Circling for height, we wheeled over the one-time Summer Palace of "Old Buddha," Empress Dowager Tzu Hsi, colorful figure of the Ching, or Manchu, dynasty.

Early-morning sunlight flashed on its elaborate courts, pavilions, temples, and limpid man-made lake. A "woman's $30,000,000 whim" it has been called, but the money which Old Buddha diverted from the Chinese Navy for its building gave Japan one of its first expansion victories in Manchuria and China in 1894-5.

Below us, a few moments later, slipped the maze of glittering golden-tiled roofs of the moat-encircled Forbidden City in the heart of Imperial Peking.*

Here, from the Dragon Throne within its stately halls, Manchu emperors ruled all China for more than two and a half centuries. Here, too, they grew soft and decadent in luxury and intrigue and finally fell when the pitiful boy-emperor Henry Pu Yi was ousted by republican revolutionaries in 1912.

It was this same Pu Yi whom fate overtook the second time after Japanese overlords of Manchuria had resented him on the throne in the land of his ancestors.

### The Great Wall from the Air

Flying northeastward toward Mukden, we passed high over the mountain barrier that shuts off Manchuria and Jehol Province from North China (map, page 5951). Atop its [illegible] of the Great Wall, upon which for centuries the Chinese had relied without success to stave off invasions from the north.†

Then came the plains, a vast expanse of rolling land patterned with fertile farms. To Masden, later to Seepingkai, and on to Changchun we rode above a panorama which, save for the smaller size of the farms, reminded me of our own Middle West.

Fifteen years before when I visited Manchuria [illegible] China flocking into this land of plenty. Quitting crowded Shantung and Hopeh, they had surged northward by steamer, by sailing junks, and by railway. Some even trekked the long, dusty land trail on foot.

In the 1920's this mass migration of colonists into the wide, fertile Manchurian plains

* See in the NATIONAL GEOGRAPHIC MAGAZINE, "The Glory That Was Imperial Peking," by W. Robert Moore, June, 1933; "Approach to Peiping," by Maj. John W. Thomason, Jr., February, 1936; "Peiping, the City of the Unexpected," by James Arthur Muller, November, 1930; "Peiping's Happy New Year," by Hooker Kin Leong, December, 1936; "Peaceful Plant Blooms Above Peiping," by F. H. and J. H. Dorset, October, 1937.

† See "A Thousand Miles Along the Great Wall of China," by Adam Warwick, NATIONAL GEOGRAPHIC MAGAZINE, February, 1939.

Carriages, Peasants, and Pedestrians Cluster in a [illegible] Market Place

[illegible]

[illegible] the struggle [illegible] [illegible] (page [illegible]).

[illegible] Province [illegible] Japanese [illegible] Manchukuo [illegible] square miles [illegible] half [illegible] small farms.

[illegible] North [illegible] the [illegible] actual [illegible].

Mountainous [illegible] Mongols [illegible] west of the Great Khingan Range [illegible] Khingan [illegible]. The [illegible] Khingan Range [illegible] Khingan [illegible] Range.

[illegible] the Yalu River, [illegible] 9,000 feet.

### A Land of Small Farms

[illegible] hills [illegible].

[illegible]

Here Empty Echoes Replace the Sound of Whirring Generators

[illegible]

it is one of the richest agricultural areas on earth.

I got amazing farm patterns with their strips of [illegible] across the [illegible] [illegible] Then Mukden lifted itself from the haze on the horizon.

Larger and larger it grew until our [illegible] seemed to stand [illegible] of its big [illegible] Then the [illegible] stooping [illegible] factory chimneys, tall [illegible] buildings, [illegible] streets, and [illegible] parked [illegible] and the [illegible] of [illegible]

This would be [illegible] a town if we could

see it [illegible] we [illegible] planned [illegible] ing [illegible]. The pilot was [illegible] his [illegible] to [illegible] [illegible].

I was bewildered by Mukden's [illegible] since I had last seen it.

Largest [illegible] and [illegible] Mukden, or Shenyang, [illegible] leading city of Manchuria. As [illegible] center of trade [illegible] the increasing [illegible] of the [illegible]

Since [illegible] were built it has been the [illegible] South Manchuria Railway line.

---

[illegible]

Under recent Japanese rule its business districts had grown larger, more modern, and more confusing.

Today the old walled town, with its ancient Manchu palaces and teeming Chinese streets, seems almost like a small courtyard enclosure on the city's big map plan.

In its present confusion probably no one knows how many people Mukden holds, although several officials with whom I talked later hazarded the guess that the population was between 1,200,000 and 1,500,000.

Factories hem the city in a gigantic circle. Here the Japanese had built textile mills, machine-tool shops, chemical factories, cement plants, and a variety of other industries.

### Mukden Wounded by War

From the air we had seen many broken and burned buildings. From the ground, as we visited some of these big industrial workshops, we learned how badly the city had been wounded by war. Many had been wrecked, pilfered, or almost bodily carried away. Few of those remaining intact could function because of the shortage of power.

Only a pitifully feeble pulse of electricity coursed through the city's network of wires. Sometimes there was none at all. In the hotel we often lighted our way to bed by candle. All the water had to be carried in buckets, as power pumps couldn't operate.

Streetcars had stopped. To get around town we resorted to battered horse-drawn carriages [illegible] rickshaws pedaled by coolies (page 398). Of course one could also walk!

Mukden normally relied mainly upon electricity fed into its lines from generators at Fushun, those at the Sungari River dam (page 406), and units on the Yalu, near Antung.

During the years that the Japanese had held the country, they had built up many hydroelectric and steam-operated plants and fed them together into an elaborate network to supply power to the rapidly expanding industrial towns.

When V-J Day came virtually all of the industrial setup throughout Manchuria remained intact. During the months of their occupation, however, the Russians systematically stripped the country of essential parts from factories and carted away generators from the electric power plants as "war booty."

At Fushun and on the Sungari I later saw the empty generator rooms and transformer units from which the equipment had been taken (pages 390, 391, 407).

In the subsequent fighting between the Nationalist and Chinese Communist armies many buildings in many cities had been gutted by fire or demolished by shells when one army group or another had used them as barricades. More factories were wrecked or plundered of valuable equipment while standing idle and ungarded.

As the result of this extensive damage, industry in Manchuria has been almost completely paralyzed.

Many of the people I met at the factory districts about Mukden were out of work. Some had had their homes destroyed. Inflation continued to spiral to fantastic heights.

### "Flea Markets" Have Most Goods

Busiest spots in town were the "flea markets," those open-street trading places where odds and ends of Japanese goods cluttered small stalls and were stacked on the walks.

From morning till evening these centers were packed almost solid with crowding, milling humanity. How the Chinese second-hand dealers ever kept account of all their miscellaneous goods I shall never know.

Here were much-handled clothes, dishes, nameless medicines, electrical equipment, suitcases, soft-drink stalls, rags, broken gadgets, and junk (page 400).

Every few feet were Chinese money-changers. Besides the Manchurian currency which was still in use, they had American dollars, Russian occupation rubles, and Nationalist notes whose inflation was such that, to have any value, they bore two or three zeros.

Only when it rained could you elbow your way along even the middle of the street.

One day, when I was over near one of the railway stations to photograph the tall stone shaft topped by a tank which the Russians erected as a war memorial (page 396), I saw a long procession of carts approaching.

For a moment I thought it was some religious or victory parade, as they were flying banners.

However, the carts were filled with Japanese civilians carrying small bundles of personal possessions. The cars were mustering Lt. Cols. The men, women, and children were being assembled for repatriation.

I followed the procession to another railway station where the people again were checked and entrained for the port of Hulutao.

Smoothly, and without confusion, Chinese and American officers handled these hundreds of incoming people. I commented on the efficiency of the operation to an American captain.

"We should have a system by now," he


Manchuria, Meaning Soviet Russia, Extends as Far North as Labrador and Hudson Bay

**To Guard Against Attacks of Rival Communist Groups, Nationalists Rush Pillboxes to Muhdan's Streets**

[illegible]

**Treated to Fiery Chinese Whisky and Peanuts, Workmen Celebrate the Reopening of an Oil Plant**

[illegible]

Triumphant Soviet Forces Raised This Tank-crowned Monument in Mukden

[illegible] Station of the old South Manchuria Railway. A [illegible] by the [illegible] erected in Changchun. The [illegible] Japanese forces in Manchuria [illegible] before Japan sued for peace. Much of [illegible]

[illegible]

"How many Japanese were there in Manchuria?" I asked.

"[illegible]," he responded. "All I know is that plans for repatriation called for something like 1,400,000 persons."

With [illegible] I arrived by train to Fushun, 20 odd miles east of Mukden.

A precocious offspring of the South Manchuria Railway [illegible] is one of the world's largest [illegible] coal mines. It also has [illegible] a [illegible] factory [illegible]

[illegible] of shale.

The Chinese mayor and mine [illegible] [illegible].

### A Rich Coal Seam

Out at the edge of the city we looked down [illegible] earth. Millions of tons of coal have been hewn from its huge seam, which is some 400 feet thick at one end and about a third as thick at the other. The vast rent is more than four miles long and nearly a mile wide [illegible].

Coal Diggers Have Hewn a Mighty Stair-stepped Gash in the Earth at Fushun

[illegible]

[illegible] peak production year," explained the director. "In that year they produced 7,270,000 metric tons of coal from the open cut and the near-by Baifu mine. From that time until the end of the war the output gradually declined, but not from lack of coal. The Japanese had neither equipment nor men [illegible] overburden before we can do major mining."

We rode down to the bottom to watch the Chinese miners at work. At the time their output was only about 3,000 tons a day [illegible] depth of 541 feet. But that is [illegible] distance it has been exploited.

Overlying the [illegible] of shale, from which the Japanese got their oil. It [illegible] and gasoline. They had built two plants [illegible] capacity of 250 tons of crude oil a day.

When we dropped in to visit the [illegible] Chinese workmen were gathered around trucks in the yard and were celebrating [illegible] of Ferry [illegible] that day [illegible] connected in [illegible] operation in a part of the

**Japanese Architects Transformed Changchun into a Modern Capital City**

[illegible]

old plant so that it could produce about 30 tons of crude oil daily (page 395).

The place reeked with the smell of hot oil. Not so the power plant, for that had been stripped of a major portion of its equipment and could not be recommissioned.

Over at the big power plant we walked through the generator and boiler rooms, which now are almost empty. Remains of a temporary railway still led to a hole in the wall through which some of the heavy equipment had been taken.

"Soviet forces removed generators producing 210,000 kilowatts of the plant's 255,000-kilowatt capacity," explained the engineer who conducted us through the gaunt rooms and over rubble that cluttered the floors (pages 390 and 391).

"Only the older generators are left, but we've kept them in operation. Now we're reconditioning some still older spares which haven't been used for a long time except for local emergency power," he continued, as he led us into an adjacent building. Here men were just finishing the fitting of a new steam room and were removing some boilers.

### Many Plants Destroyed

That night we ate dinner with the mayor and some of the engineers. As we wielded chopsticks through fish, fowl, pork, and rice courses, we heard more about the destruction of other plants.

One engineer estimated that the steel plant we had seen, where the Japanese made sponge iron directly from the ore, was at least half destroyed. The aluminum plant, too, had been heavily gutted in the "war booty" grab.

The industries, local hospital, schools, and even our hotel at Fushun bore the touch of the Japanese-owned South Manchuria Railway, or "SMR." Until the Manchuria Industrial Development Corporation was organized in 1937, to control heavy industry and subsidiary enterprises (page 400), virtually every field of big business in the country was linked with the SMR.

When it was organized in 1906 after the Russo-Japanese War, the SMR's activities were concerned with some 700 miles of railway and the Fushun coal mines, which then produced only 300 tons of coal a day.

It grew into a remarkable enterprise and employed a staff of 400,000.

Running railways became only a small part of its job. This semigovernmental concern mined coal, produced oil, made steel, and even ran earthenware and pottery factories.

It built and operated hotels, libraries, schools, and hospitals; built harbors and warehouses; organized agricultural experiment stations; and conducted research in geology, chemistry, and economics.

Some have dubbed it the "East India Company of Manchuria."

The elaborate development of Dairen was one of its proud accomplishments. By ruinous dredging the port was increased to 12,000,000 tons' capacity. The city became a show place for planning.

After Japan wrested Manchuria from the hands of the Chinese late in 1931 and early 1932, the SMR assumed the management of [illegible] the old Chinese Eastern Railway when, in 1935, the Russians sold their interests for nearly $80,000,000.

### More Railways than in China Proper

When the Japanese gained full control, Manchuria had some 3,400 miles of railways. They since had built more, so that the country now has a total of 9,300 miles—a greater network than exists in all China proper.

The SMR also ran ships on the Sungari, Amur, Liao, Nonni (Nun), and Yalu Rivers and put buses on hundreds of miles of highways.

At present, considerable portions of the railway are not in operation, as many bridges have been blown up during the prolonged Chinese conflict. Obviously, no link by ship, rail, or road exists between the Nationalist- and Communist-held territories.

Back in Mukden, I inquired about getting down to Dairen and Port Arthur (which the Japs called Ryojun), on the lower tip of the Liaotung peninsula. These places they got as the result of the Russo-Japanese War in 1904-5.

According to the terms of the Yalta agreement and the Chinese-Russian Treaty of August 14, 1945, Port Arthur is to become a Chinese-Russian naval base. Dairen, or Talien, is constituted as a free port. But with Soviet administrators, technicians, and guards now in possession, I found that correspondents still were unwelcome.

With no Japanese treaty yet signed, Russia still remains technically at war. And it was on this technical basis that she recently ordered a U. S. Navy courier vessel to leave port at the end of the specified time limit.

But one could get down to Anshan, about a quarter of the way. Here, in an area with an abundance of iron ore, the Japanese built a huge steel plant.

Particularly after Japan embarked upon her war program, the installations were intensively expanded. Here they erected a

Mukden's Cloth Market Does a Thriving Trade

[illegible]

[illegible] on the Mukden-Antung [illegible] Cotton & Cotton [illegible] [illegible] Mukden [illegible] there was definite unhappiness. Antung, another town in Manchuria, is industrial "Ruhr." Lies behind the Communist line and was likewise "out of bounds."

According to Mukden [illegible]

[illegible] I met a quiet gentleman [illegible] on the train. We fell into conversation [illegible] English he explained that for the past five years [illegible] industrial [illegible] known as the Mukden [illegible] Department [illegible]

[illegible]

The Japanese [illegible] to a conference with the Lytton Commission. He carried [illegible] the multitude of activities in which his organization had been engaged.

### A Land of Fantastic Wealth

On them he pointed as the rich resource that had been exploited and [illegible] [illegible] Talking [illegible] he pointed

**Nationalist Soldiers Pause for a Rest in Their March into Manchuria**

[illegible] a few moments of sleep. The Nationalist troops hold the [illegible] in control in the [illegible] The [illegible] between [illegible] Manchuria is along the Sungari River, midway between Changchun (former [illegible]), Mukden, and Harbin ([illegible])

Hopping from spot to spot on the maps, he gave a quick resume of the fantastic wealth that [illegible] in Manchuria, [illegible] of it unknown until the past few years.

[illegible] 27 billion [illegible] Most [illegible] and [illegible] the surface, so that it can be worked [illegible]

[illegible] had been uncovered [illegible] produce good [illegible] coal. In 1931, before Japanese [illegible] were [illegible] that 5,000,000 tons of coal annually.

[illegible] the lower part of the Manchuria [illegible] acquaintance unknotted an extensive [illegible]

"Most [illegible] low-grade ore, running from [illegible] to 35 percent iron content; but we found [illegible] extensive scale," he explained. "We also uncovered [illegible] parts here in the eastern [illegible]

Chosen [illegible]. The Showa works at Anshan, were our biggest plant, but there were [illegible]

My Japanese informant formed the reserves [illegible]

[illegible] west of Hulutao. "Here was quite a remarkable discovery," he noted. "[illegible] something we didn't know we [illegible]

In 1932, while exp[illegible] coal [illegible] compare with the famous Climax mine in Colorado. Before their work was halted, they had put down several mine openings over a distance of [illegible] miles to reveal a deposit estimated at [illegible]

Elsewhere, too, in the Manchurian earth are [illegible] lead, zinc, magnesite and other minerals. Recently [illegible] of rich [illegible] deposits, discovered by the Japanese

Peasant Hawkers at Stations Are Railway "Dining Cars"

[illegible] bowl of Chinese [illegible] dish of meat [illegible] bean when no food is available. Businessmen and women alike have letters of the trade.

[illegible] land was well behind.

But in some [illegible] fields lay fallow [illegible] were left [illegible]

## Shortage of Tractors and Draft Animals

Some will wonder why [illegible] at war for six [illegible] complained that [illegible] shortage of tractors and draft animals on the farms. Tractors had worn out or [illegible] Many of [illegible] were requisitioned [illegible] to the [illegible]

[illegible] UNRRA [illegible] funds, I learned that [illegible] had relied heavily on that organization to furnish [illegible] plantings.

UNRRA, however, had arrived late because of the civil [illegible] Chinese [illegible] only [illegible] problem of [illegible] for wide-scale planting.

To relieve the shortage of work animals, the director had suggested the possibility of importing Mexican mules. But the people were not sure about them—whether they were the right [illegible] would [illegible] Mexican [illegible]

[illegible] there would be [illegible] problem [illegible] a good old American Missouri mule, used to a [illegible] vocabulary, [illegible] Chinese-speaking mules.

As you rode through the cultivated land

[illegible] Chang [illegible] war, in an area 150 miles northeast of Port Arthur.

Despite [illegible] Manchuria [illegible] land. [illegible] produce some 70 percent of [illegible]

[illegible] and then covering [illegible] of the central plain by train. [illegible] warm Manchurian earth [illegible]

[illegible] people [illegible] are [illegible]

Rice [illegible] wheat [illegible]

[illegible]

[illegible] Japan proper, and [illegible] the United States, however, have produced more. Manchuria [illegible] Wheat [illegible] of the crop was [illegible] beans, [illegible]

[illegible] Korean immigrants raised considerable quantities over near the Korean border.

Among the amazing changes that the Japanese created in Manchuria, [illegible] town of Changchun is perhaps the most [illegible]

When we rode in from the [illegible] capital of peace, about [illegible] [illegible]

[illegible]

[illegible] Japanese families [illegible]

Capturing Noodles with Chopsticks Requires Concentration!

[illegible]

Then, in 19[illegible] [illegible] Manchukuo [illegible]

[illegible]

[illegible]

The Japanese military [illegible]

Humbled by Defeat, a Japanese Colonial Serves as Barber to the Chinese

[illegible]

[illegible] State Building [illegible] Building in Tokyo.

[illegible] set out to create [illegible] capital.

Unfortunately, many of these [illegible] structures were [illegible] fighting between the Nationalist and Communist Chinese troops in the [illegible]

[illegible] Manchuria's towns [illegible] Changchun [illegible] structure [illegible]

[illegible] Russian [illegible] the owner had [illegible]

### Relic of Manchu Splendor

The [illegible] Changchun I [illegible] Henry Pu Yi. [illegible]

and golden-tiled roofs indicate that this was the abode of the Imperial Manchu family (page 407).

Here was little of the splendor with which Pu Yi was surrounded when, as a child, he sat on the Dragon Throne in the Forbidden City in Imperial Peking. But physically he was undoubtedly more comfortable, as the buildings had steam heat, white-tiled kitchens, and many modern conveniences. The old palaces in the Reserved City of Emperors in Peking, despite their ostentation, must in winter have approached living in a barn!

When I saw it, the Changchun palace was a shambles. Virtually every plate-glass window was shattered by bullets; all the doors had been pried off and carried away. A section of wood flooring had been ripped out for firewood when Chinese troops camped there.

The rooms which have Japanese-styled ceilings had been emptied, sandbag barricades still blocked the front terrace, and Chinese slept in the halls to escape the noontime summer sun.

The palace dominates a low hill in the northeast suburbs of town hard beside the railway tracks and overlooks a few factories and poor mud hovels. It gives you a feeling that, though in the capital, it was little of it.

The city planners, however, had started to build another palace at one end of the mall-like axis of their federal city project. War halted the work shortly after the foundations had been laid.

During the few years that it was capital, Changchun grew to a population of some 800,000 persons, of whom 250,000 were Japanese.

### Curfew, Now, for Japanese

At the time of my visit the Japanese civilians had not yet been repatriated. Many were selling their personal possessions in open street markets.

Most of the stores, however, had already been taken over by Chinese merchants. Jazz bands were noisy in "night" clubs, but only in late afternoon and early evening. Japanese hostesses left at 8 o'clock to get home before early curfew.

In the center of one of the chief axial circles, [illegible] to post and telegraph offices, police bureau, and central bank, the Soviet forces erected an imposing war memorial. It is a tall pylon, atop which perches a replica of an airplane bearing red-star markings. The dedicatory tablet on it reads: "Eternal glory to the heroes who fell in battles for the honor and triumph of the Soviet Union."

When I was in Changchun, Harbin (Pirkiang) was in Chinese Communist hands. The Nationalist and Communist armies faced each other in uneasy truce along the Sungari River about midway between the two cities. As I write, they still do (pages 401, 408, 411).

With several newspaper correspondents I waited, hoping to see that interesting city and perhaps also get a chance to visit Tsitsihar (Lungkiang), Hailun, and Hailar (Hulun), still farther to the north and west.

One day news came over from Advance Executive Headquarters that American truce representatives were flying with a Communist general to Harbin and that press delegates could go along. Some of those who had sweated out the Manchurian "show" longest were selected.

They went and saw what they could before they were told that their mission had been completed!

Even more than other towns in Manchuria, Harbin savors of the fantastic. It was spawned at the time the Russians built the Chinese Eastern Railway, that short cut route between the Trans-Siberian near Chita and the port of Vladivostok.

It flourished and was fattened on the trade that was gathered both by the railway and by boat traffic on the Sungari River. The collapse of Czarist Russia during World War I contributed to its fantastic quality when thousands of White refugees fled into Manchuria. Large numbers have stayed in Harbin.

The correspondents saw Russian ballets, were toasted with Russian vodka, ate in Russian restaurants, and photographed the onion-shaped towers of Russian churches.

But they also witnessed huge Chinese Communist demonstrations, haggled with Chinese merchants, and somehow got along on Chinese banquets that have been limited to only 24 courses "because of the war!"

To them both Changchun and Mukden later seemed "rugged!"

### By Rail to Kirin

While they were enjoying the fleshpots of Harbin, I boarded a military train and traveled eastward to Kirin (Yungki), over in the Sungari River.

After quitting Changchun the train slowly puffed across the plain and wound through green valleys between low hills. Perched on one hill was a small temple with a shrine at its gateway. About it a crowd had gathered, and flutists were filling the air with wailing tones.

Many of the men who milled about in the religious gathering wore headdresses of leaves. Whether it was part of the rite or only to keep

The Hsiao Fong Mien Dam, a Few Miles from Kirin, Harnesses the Sungari River for Power

[illegible]

the [illegible] I didn't know. My [illegible] when he [illegible]

As we [illegible] the [illegible] from the [illegible] had been stripped away.

One of the large units manufactured [illegible] rubber for [illegible] A third [illegible] from the [illegible] of coal [illegible] way, a few miles to the west.

Kirin [illegible] concentration [illegible] In recent years [illegible] wall [illegible] tidy [illegible] walled houses gave it a feeling of age which indeed it has.

Into Manchuria gained its [illegible] [illegible] Kirin [illegible] Hsiao [illegible] portant [illegible]

Symbol on the Gate Shows That Here Was the Palace of Puppet Emperor Kang Te

[illegible] Sandstone statue. [illegible] Later they took him to [illegible] October, 1948. The palace was [illegible]

sured both by a railway and by [illegible]

And now, too, by hydroelectric power. [illegible] a low [illegible] across the river to create a reservoir holding more than 14 billion cubic yards of water.

[illegible] the not-too-tender [illegible] of a Chinese taxi cums driver, I bounced out in a weapons carrier over the rough, hilly road to look at the mighty dam and power plant and talk with the engineers.

The dam is nearly 200 feet high and more than two-thirds of a mile long.

When the Japanese quit, the top of the dam was still unfinished, but they had two generators in operation. Four others in the 500,000 kilowatt project had been installed, and the last two were nearly completed.

Today, only the two operating generators remain. Soviet workmen took apart the other six and hauled them away, together with the turbines. They removed also five of the eight transformer units and even the control panels and switchboards in use.

To safeguard what power remained, lest floodwaters spill over the uncompleted top of the dam and flood the generator plant, Chinese workmen were busy pouring concrete to finish

Carrying Fluttering Banners and Flags Communist Chinese Gather for a Mass Meeting in Harbin

[illegible]

Mongol Herdsmen Possess Large Flocks of Sheep and Cattle on the Treeless Plateau Lands of Western Manchuria.

**Beside a Wrecked Bridge on the Sungari Volunteers Hack for Mummies Hidden among the Rocks**

[illegible]

Student Orchestra and Choral Group Give an Entertainment in Communist-held Tientsin

"Aw Shucks, the Schoolhouse Is Wrecked, but We Have Classes Anyway!"

[illegible]

"Fill Er Up," Says the Chinese, but He Means with Soda Water

[illegible]

In Hot Summer Sun Old Dobbin Welcomes a Drink

[illegible]

of [illegible] productive portion [illegible] water came.

**Floods on the Sungari**

Floods come every [illegible] years [illegible] and [illegible] the [illegible] we expect [illegible].

Floods are a menace of the Sungari, but they can hardly be predicted with such accuracy. [illegible] has occurred only [illegible].

In [illegible] its rushing power, the dam should help curb some of the wrath of the river. Still another advantage that has accrued from the dam [illegible] is that the reservoir now permits a water approach to the [illegible] country [illegible]. Kirin possesses one of the few paper mills in Manchuria.

Although I saw the [illegible] two near Kirin [illegible] several others [illegible] however, only one of its [illegible] accomplished and can be reported.

When I returned to Kirin from my [illegible] I [illegible] with the Governor of Kirin Province [illegible] Deputy Commander of the Northeast China Peace Preservation [illegible] Northeast [illegible] was accredited to that area!

## A Genial Host

Gen. [illegible] was a genial host [illegible] that one had to search [illegible].

Here in Kirin, beside the Sungari, I [illegible] the [illegible] of the Manchus.

[illegible] the Sungari [illegible] Ch'ang Pai Shan, or Ever White Mountains, [illegible] the story [illegible].

Here [illegible] a maiden of divine origin saw a lovely lotus blossom floating on the mirrored surface of the water. She was commanded to pluck it, and thereby conceived and gave birth to a son [illegible] Manchus.

[illegible]

Either fearing comment or still following command, she placed the infant in a birch-bark cradle and set him adrift on the Sungari, where warring clans found him as he drifted downstream. Forthwith the warriors decided to make peace among themselves and install him as their leader.

Owen Lattimore tells a similar legend, but in the version he heard the maiden supposedly ate a red berry that had been brought by a bird.*

### The Strong Man of Manchu History

The strong man in Manchu history, however, was Nurhachu, who welded his people together and established Mukden as the Manchu capital in 1625.

Possessed of a fresh vigor for war that the Mongols, Koreans, and northern tribes had lost, Nurhachu and his successor extended Manchu domination to the west, north, and east. And then, flushed by their quick successes, the armies turned southward and stormed the Great Wall to capture Peking.

The conquest, which led to the complete control of all China, was not, however, due entirely to the Manchus' mastery of arms. The Great Wall was breached partially because of a woman!

A Chinese general who guarded the frontier had become disgruntled at the loss of his favorite concubine to a usurper in Peking and willingly lent his aid to the northern invaders.

For a considerable time during their long rule over China, the Manchu, or Ching, emperors held Manchuria apart for their own people and as a "royal reserve," and recruited here the military manpower to guard the Empire.

Gradually Manchuria was sapped of its manpower, and immigration bars were lifted. The entry of Chinese colonists came first as a trickle, then as a stream. After Imperial power fell in 1912, migration into these rich comparatively empty lands was like flood water from a broken dam.

In the 1920's particularly, Chinese colonists rushed into Manchuria by the millions, a historic mass movement of peoples (page 389).

Even in their heyday the Manchus were never a numerous people. Today, probably not more than six percent of the people who live in Manchuria can be classed as pure Manchus.

Some live in the northern part of the country, but most of the race has been absorbed by the Chinese and dress as do their Chinese fellow men.

Out in the western part of the country, on arid lands bordering Mongolia, also dwell seminomadic Mongols with their herds of cattle and sheep (page 409). In the country, too, are some primitive Tatar tribesmen, Korean immigrants, and White Russians.

But fully 90 percent of the population is Chinese, perhaps more, now that the Japanese are being sent home.

### Five Times China Was Invaded from Manchuria

It has been said that whoever holds Manchuria holds a spear pointed at the very heart of North China. Five times in the past that has proved true.

First came the Khitan Tatars; then rose the Nu'chens to set up North China kingdoms. Through the Great Wall later rode the Mongols to build the fabulous empire of the Khans. Fourth in turn were the Manchus. And then the Japanese with their "Co-prosperity Sphere" came afoot.

Although these latter overlords wrested more wealth and sinews of war from Manchuria than ever had been known before, theirs was the briefest stay of any conquering power.

The Manchurian drama, however, has not ended with their going. At the moment headlines feature civil strife. Rich and strategic, Manchuria is one of those focal spots on the globe that always make news.

* See "Byways and Backwoods of Manchuria," by [illegible] January, 1932.

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In Mexico, The Society and the Smithsonian [illegible] [illegible] Characteristic of [illegible]

[illegible] America, and revealed a great center of early American culture, previously unknown.

[illegible] The Society and the U. S. Army Air Corps, the world's largest balloon, Explorer II, as- [illegible] world altitude record of [illegible] Capt. Albert W. Stevens and Capt. Orvil A. Anderson [illegible]

[illegible]

The Society cooperated with Dr. William Beebe in [illegible] depth of [illegible] feet was attained.

The Society granted $25,000, and in addition $75,000 [illegible] members, to the Government [illegible] were thereby saved [illegible]

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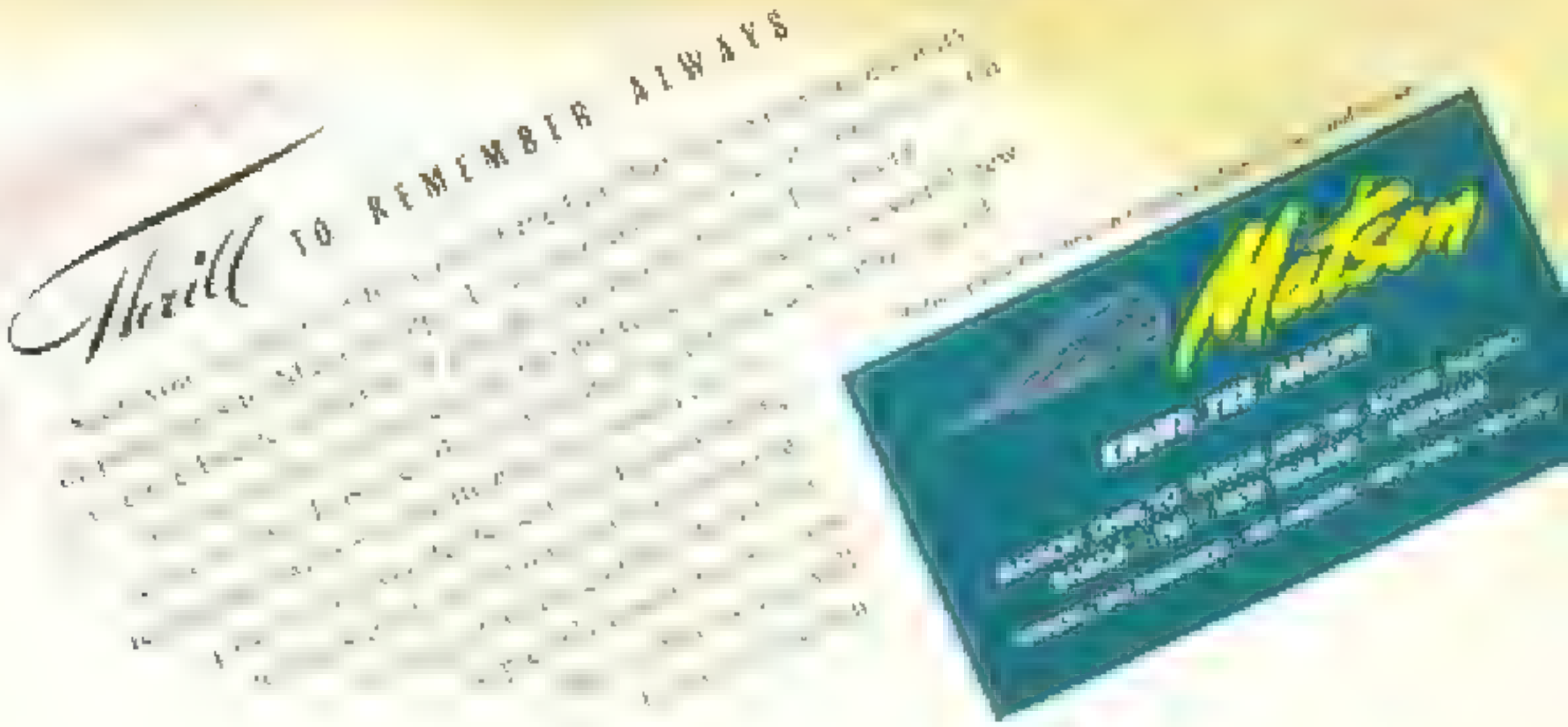
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# *Are you handcuffed to your secretary?*

**That's what** [illegible]

[illegible]

[illegible]

[illegible]

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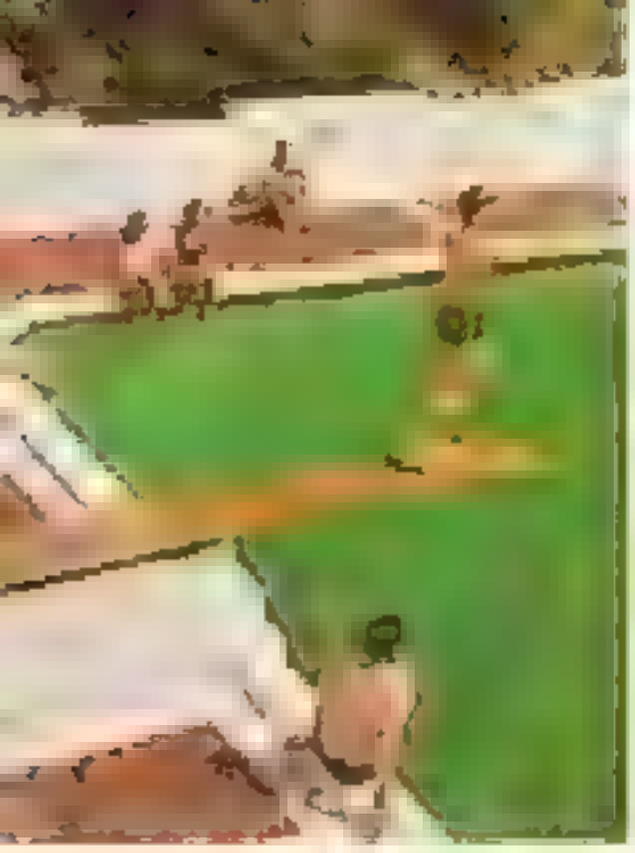

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[illegible] for this progress, along with [illegible] made by the medical [illegible] improvements in medicines and medical equipment.

Synthetic organic chemicals now are used in the [illegible]

[illegible] filling life—just as in transportation and communication [illegible] of man's progress [illegible]

*Producing better materials* [illegible] *Union Carbide.*

[illegible] required, particularly in the fields of [illegible] Working with extremes of heat and cold [illegible] below zero [illegible] with vacuums and great pressures, Units of UCC now separate or combine [illegible] of the many elements of the earth.

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*[illegible]*
[illegible]
[illegible]
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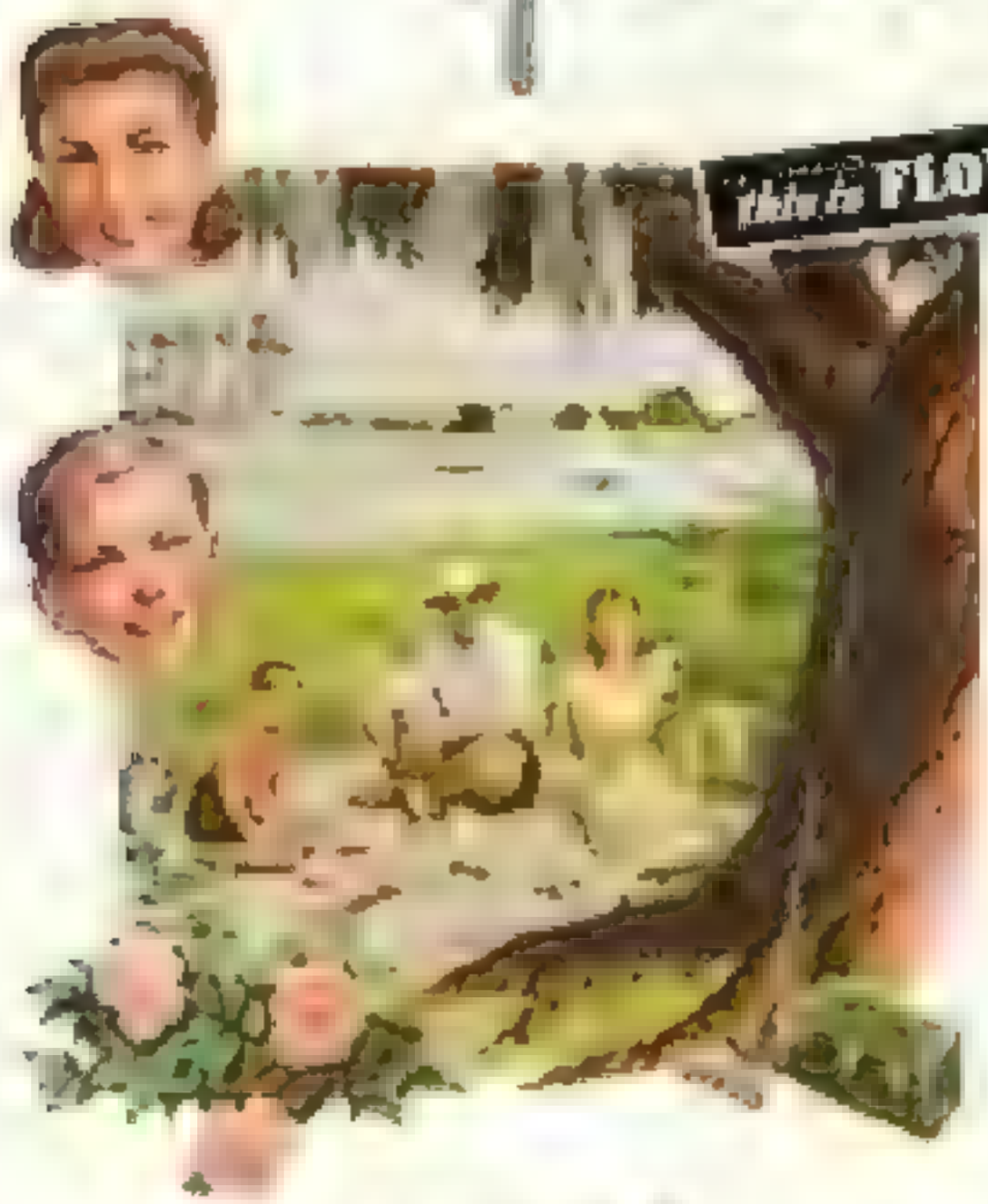



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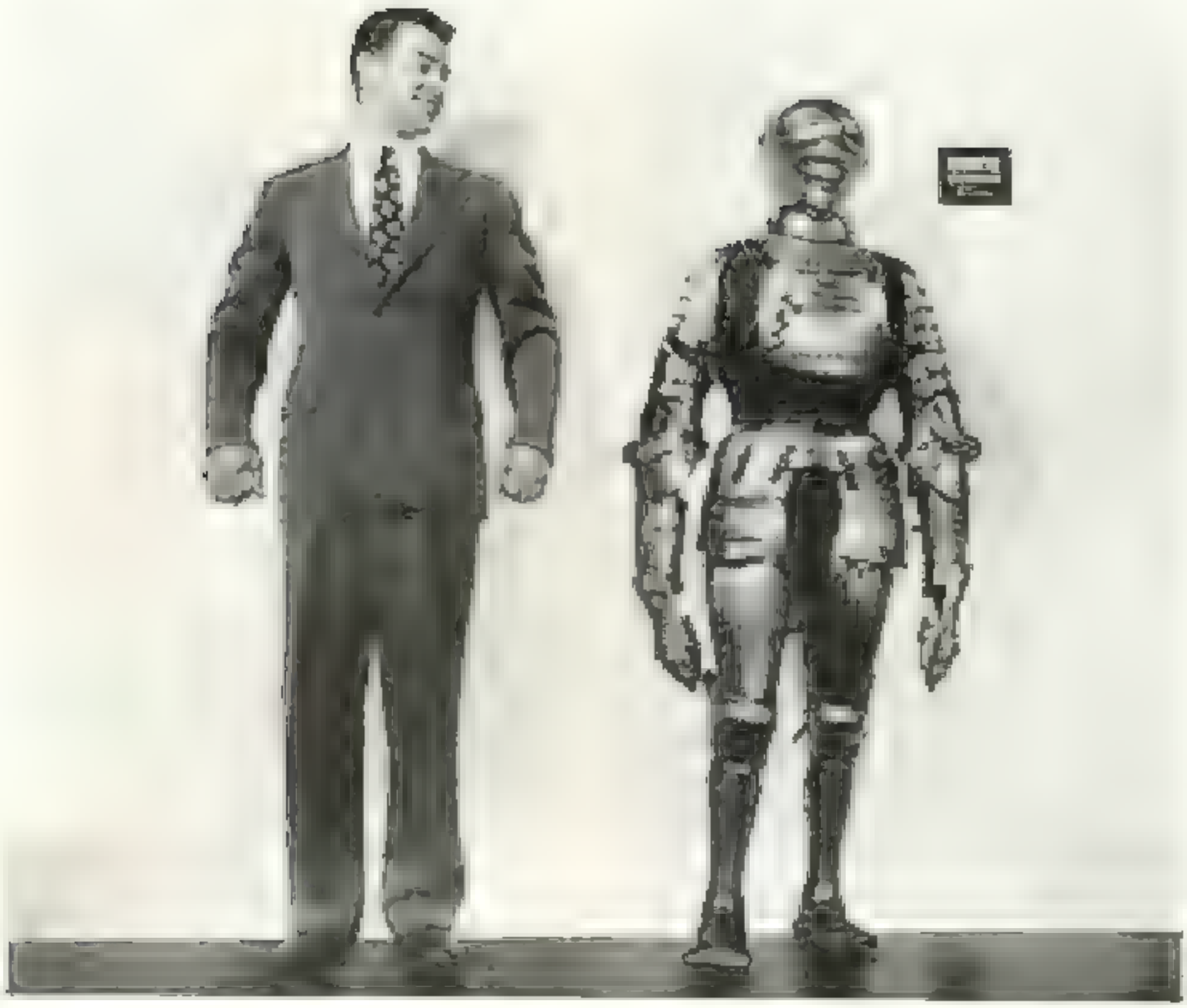

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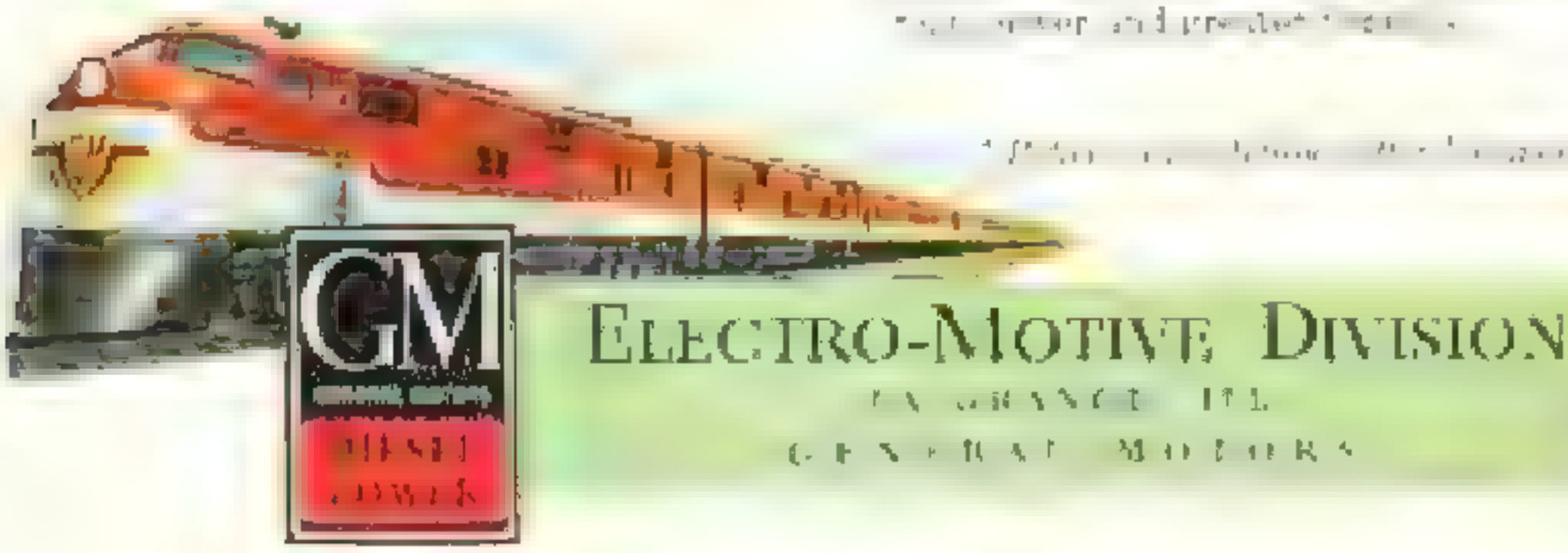
[illegible]

[illegible]



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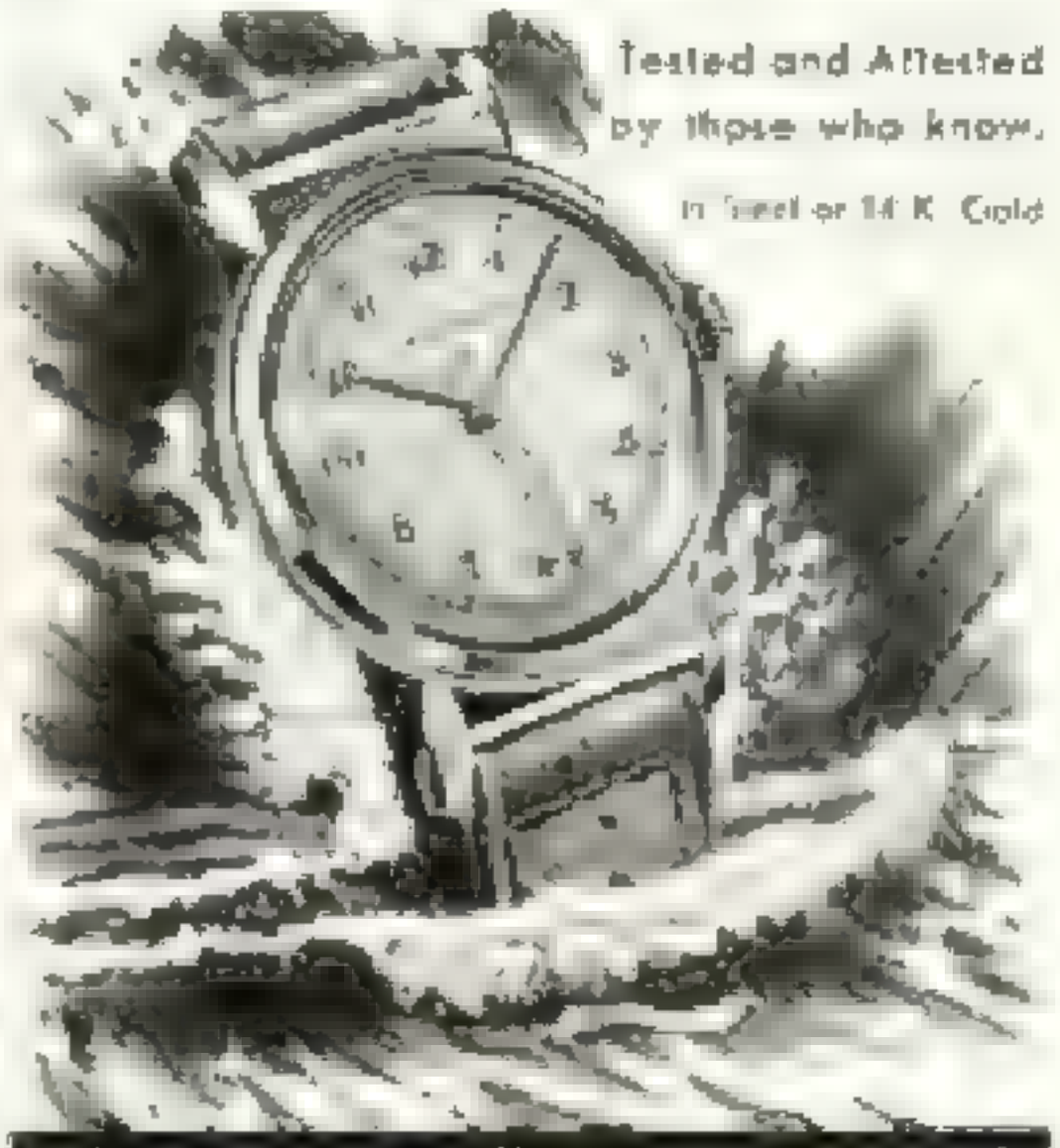


Tested and Attested by those who know.

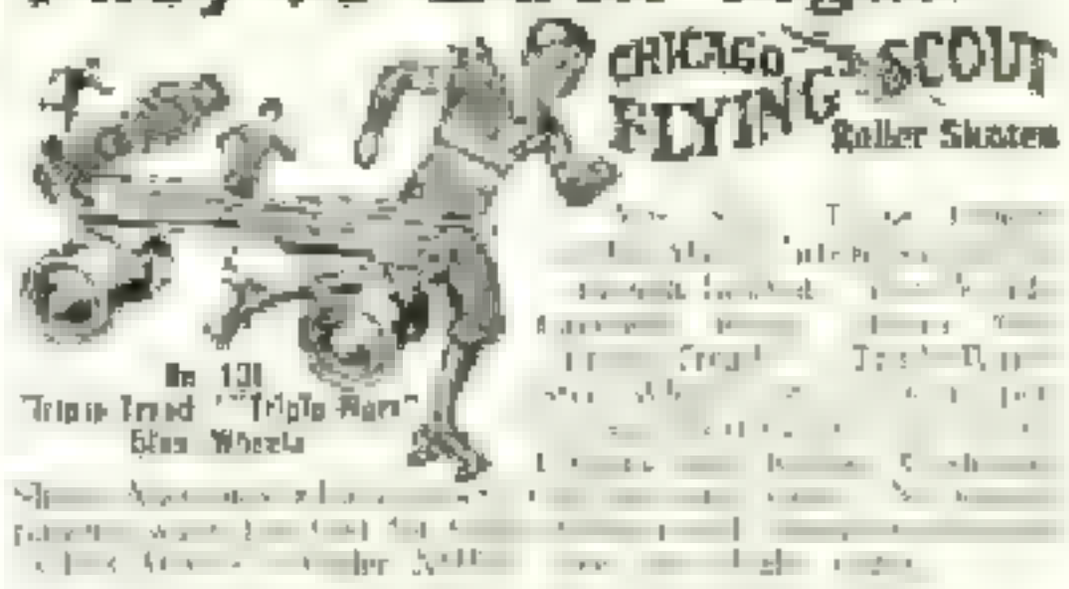
in Steel or 14 K Gold

**MOVADO**

WINNERS OF 165 OBSERVATORY AWARDS

SOLD AND SERVICED BY LEADING JEWELERS ALL OVER THE WORLD

# They're Back Again!




**CHICAGO ROLLER SKATE CO.**

World's Greatest Roller Skates for over 45 years

4408 W. Lake St., Chicago 24, Ill.

**New: Exclusive!** [illegible]

Undisturbed slumber—all night, every night—thanks to

# G-E AUTOMATIC SLEEPING COMFORT

**How you'll love** [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

**G-E Automatic Blankets**

FIRST IN SLEEPING COMFORT

**GENERAL ELECTRIC**

**Bedside Control** [illegible]

**Big savings!** [illegible]

# FALSE TEETH WEARERS



*Use* **POLIDENT** *Daily* TO KEEP PLATES AND BRIDGES CLEAN . . . AND ODOR-FREE!

# Overweight may menace your health,

especially if you are over 30, for it often goes hand in hand with high blood pressure, heart ailments, diabetes, and other diseases.

The chief cause of overweight is overeating. It rarely results from glandular disturbances or other causes.

If you are overweight, follow your doctor's advice for bringing your weight down to normal, or a little below. Keep it there *—and help assure a longer, happier life!*

For further helpful information, send for Metropolitan's free booklet, 37-N, "Overweight and Underweight."

It contains lists of the calorie values of almost 300 foods, suggested low-calorie menus, illustrated reducing exercises, and a table of ideal weights.

**Metropolitan Life Insurance Company**

A MUTUAL COMPANY

TO VETERANS - IF YOU HAVE NATIONAL SERVICE LIFE INSURANCE — KEEP IT!

# Their guest room was a chamber of horrors

[illegible] Spanish explorer, [illegible] of the Rio Grande [illegible]

[illegible]

[illegible]

[illegible]

[illegible] the last [illegible] the Spanish [illegible] were those of old [illegible] that they had [illegible] death and [illegible]

[illegible] search for a [illegible] against the effects of [illegible] successful until modern man devised the *accurate protection* [illegible]

[illegible]

[illegible] agent or broker about a [illegible] your particular [illegible]

MORAL INSURE IN

## *The Travelers*

ALL FORMS OF INSURANCE AND SURETY BONDS

The Travelers Insurance Company, The Travelers Indemnity Company, The Travelers Fire Insurance Company, The Charter Oak Fire Insurance Company, Hartford, Connecticut.


# Sheaffer's – tops in its field !

In writing instruments it's always Sheaffer's that set the quality standard . . . STRATOWRITER proves it again! . . . STRATOWRITER is Sheaffer's newest writing sensation—the dependable, trustworthy, quality-clear through ball-pointed instrument. Neither pen nor pencil, yet possessed of many of the best qualities of each, STRATOWRITER is a gold-filled, precision built, jewelry-like instrument—with a long-life writing unit which will be replaced in its entirety (including factory-sealed supply of Strato-Ink) at any time by your dealer for only $1.00.

Complete STRATOWRITER $15.00 Federal Tax included.

**SHEAFFER'S**

*Stratowriter*


*Rolls your writing in dry*

LISTEN SUNDAYS to SHEAFFER'S PARADE, with Carmen Cavallaro—NBC Network, 3 p.m. E.T.; 2 p.m. C.T.; 1 p.m. M.T.; 12 noon P.T.

LISTEN SATURDAYS to SHEAFFER'S ADVENTURERS' CLUB—CBS Network, 11:30 a.m. E.T., 10:30 a.m. C.T., 9:30 a.m. M.T.; 8:30 a.m. P.T.

# Double Reward

## from Kodachrome in your miniature camera

**Projection:** your projected Kodachrome transparencies are the "show window" of color photography.


**Prints:** [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

EASTMAN KODAK COMPANY
Rochester, N. Y.

Kodak

# A drive with beauty...

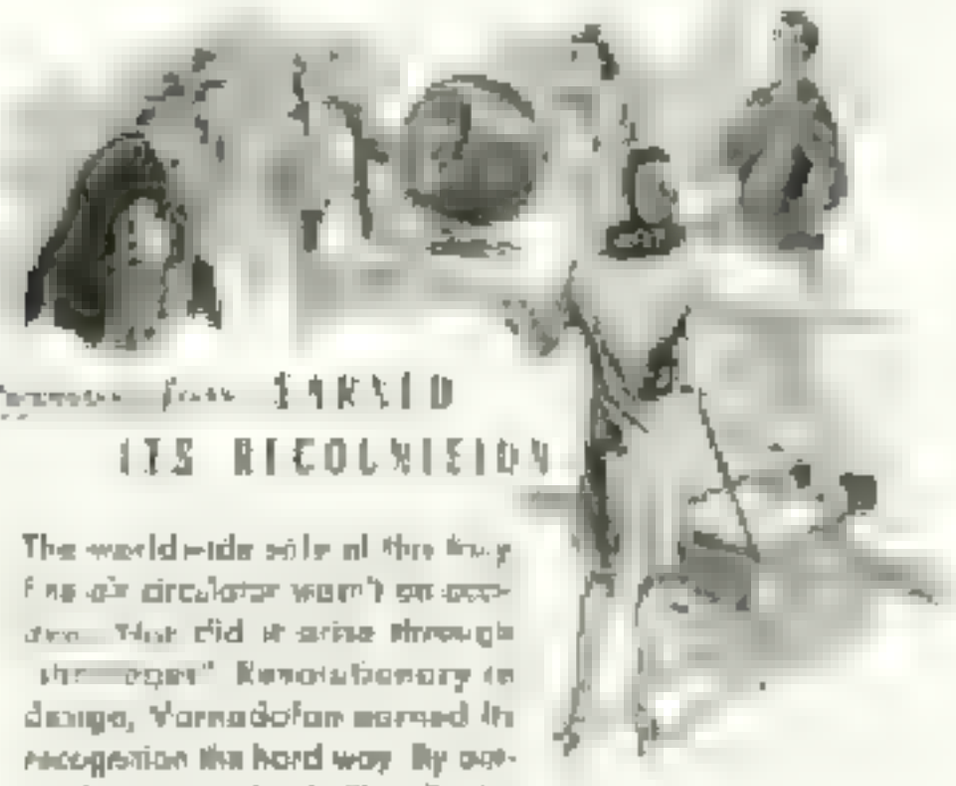

# that never ends...

How thrilling to own a new car. Can you imagine the finish even more beautiful? It will be if you SIMONIZ now. SIMONIZ adds to the richness of color . . . increases the natural brilliance. And as the years roll by, applying SIMONIZ "builds up" this beauty. Makes it permanent and more glamorous than ever. Stops ultra violet rays from fading colors . . . gritty dirt from scratching . . . corrosive airborne chemicals from dulling and destroying the finish. Always insist on SIMONIZ. Nothing takes its place. That's why . . .

## Motorists Wise Simoniz


"SIMONIZ" TRADE MARK REG. U. S. PAT. OFF. & TRADE MARK REGISTERED IN CANADA

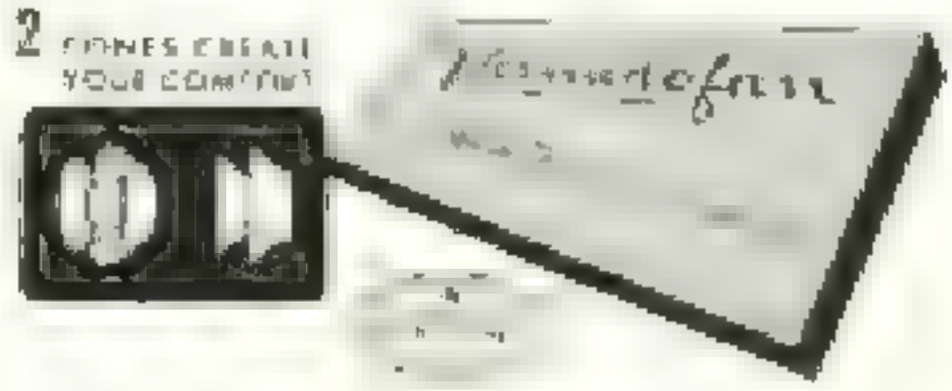
The O. A. SUTTON Corporation presents

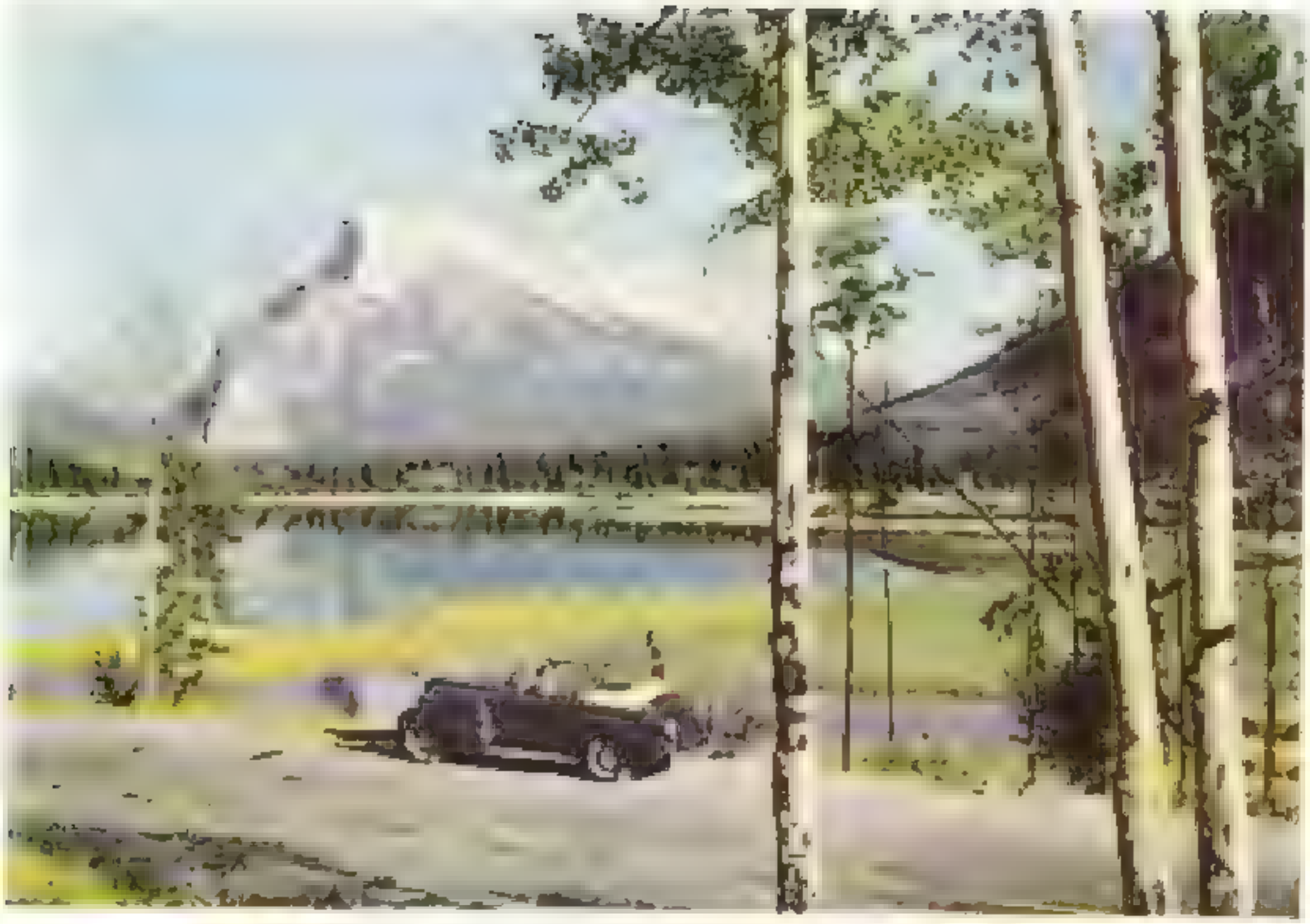


Vornado from TARVID
ITS RECOGNITION

The world-wide sale of this truly fine air circulator wasn't an accident. Nor did it arise through "shortcuts". Revolutionary in design, Vornado fan earned its recognition the hard way. By outperforming all style "fans". By doing singleheadedly the work of three or four of them! A demonstration at your dealer's will convince you in 10 minutes.

2 CONES CREATE YOUR COMFORT





JUST PICTURE THIS! Beauty awaits you in Canada at every bend in the road.

NO PASSPORT NEEDED

# "LUCKY PEOPLE"! (they're headed for Canada!)

It's time to plan *your* family holiday in friendly Canada. Just picture yourself . . . amid the scenic beauties of lake, mountain or seaside . . . enjoying your favourite sports . . . seeing new sights in Canadian cities . . . Canada offers unlimited holiday horizons. And wherever you go you're never a stranger, always a guest. Millions of visitors went exploring in Canada last year. Soon *this* year's northward trek to Canada will begin. *So better hurry and reserve your accommodation!* For information, write Canadian Government Travel Bureau, Dept. of Trade and Commerce

Hon. J. A. MacKINNON, Minister — J. E. COLLINS, Director

# CANADA

## Vacations Unlimited

CANADIAN GOVERNMENT TRAVEL BUREAU
OTTAWA CANADA

Please send me Vacations Unlimited (Please Print)

Name

Street and No.

Town Zone

**YOU'LL PICK UP** colourful hand crafts — shop for wool-lens, snowshoes, gifts

**CANADA'S ENDLESS** lakes and streams breed fish extra big and extra hard to

# NATIONAL GEOGRAPHIC MAPS ARE THE KEYS TO THE NEWS OF TODAY

## Timely—Accurate
## Ideal for Reference

TEACHERS [illegible]

**MAP INDEXES:** [illegible]

**MAP FILE:** [illegible]

## Enlarged Maps

**BIBLE LANDS—64½" x 44½":** [illegible]

**UNITED STATES—67" x 43½":** [illegible]

**THE WORLD—67" x 43½":** [illegible]

**NO. & SO. HEMISPHERES—67" x 35½":** [illegible]

**PRICES:** [illegible]

# ONLY BY GREYHOUND

## You'll find this *All-Weather* travel pleasure in *All Forty-Eight States*

● Greyhound alone, of all the transportation systems serving *This Amazing America*, can take you to and through every one of the forty-eight States, up into Canada, and down to Mexico.

Trips through the glittering snows of the North are as restful and as pleasant as travel under sunny Southern skies . . . made that way by Greyhound's efficient heating and ventilation, and by reclining cushioned chairs that travelers call "the most comfortable in transportation."

Remember... *By Highway* means *By* GREYHOUND

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IN THE

# NATIONAL GEOGRAPHIC SOCIETY

*"The Membership Dues, Which Are for the Calendar Year, Include Subscription to the National Geographic Magazine*

PLEASE FILL IN BLANK BELOW, DETACH, AND MAIL TO THE SECRETARY

_____ *1947*

*To the Secretary, National Geographic Society,*
*Sixteenth and M Streets Northwest, Washington 6, D. C.:*

*I nominate* _____

*Occupation* _____
(This information is important for the records)

*Address* _____

_____ *for membership in The Society.*

_____

_____
*Name and Address of Nominating Member*

3-47


## *How would you answer this question?*

We asked a number of people this question . . . *"How much would you say the telephone company makes (after all expenses and taxes) on the money invested in the business?"*

Twelve per cent said "6% or less."

Eleven per cent said "7% to 10%."

Twelve per cent said "15%, 20% or 25%."

Eight per cent said "30% or more."

Fifty-seven per cent had no opinion.

The actual figure is far less than many people think. Even with telephone calls at a record peak, Bell System earnings on the money invested in the business have averaged only a shade over 5½% for the last five years—including the war years. And that's not enough to insure good telephone service.

We thought you might like to know in case you have been wondering about telephone earnings.

BELL TELEPHONE SYSTEM

# CHINA

**—we've been calling there these many years**

When you read about the great new luxury fleet we, of the American President Lines, are building (ships with new speeds, new comforts)... when the day comes for you to visit the Orient... remember...

In 1867, youthful Tzu Hsi was Empress of China. Her flag, the Dragon, symbol of strength and goodness. First ships of our predecessor companies played an important part in China's commercial growth...

In 1912, China's 5-barred flag stood for the 5 Clans. Its leader: Dr. Sun Yat-Sen. Into its ports regularly steamed ships of our predecessor company, carrying Americans, building American trade.

Someday you'll want to visit China. So plan ahead for it as the world's supreme travel experience. And depend on us to provide new-fleet luxury aboard —old-hand helpfulness ashore.

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Sailing under the American flag, our liners will soon offer travelers air-conditioned, shipside apartments; superb cuisine; gay entertainment; swimming pools; cafe lounges; music; sports. Both trans-Pacific and 'Round-the-World services. Ask your travel agent or see us.

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